

MINISTRY OF HEALTH OF UKRAINE
ZAPORIZHZHIA STATE MEDICAL UNIVERSITY
CATHEDRA UROLOGY

H. V. Bachurin, Y. S. Kolomoets

**TRAUMATIC INJURIES OF THE ORGANS OF THE
URINARY AND MALE GENITAL SYSTEM**

EDUCATIONAL MANUAL

Zaporizhzhia
2023

UDC 616.6(075.8)

B 32

Recommended for publication by the Central Methodical Council

Zaporizhzhia State Medical University

(Protocol No. of 2023)

Authors:

H. V. Bachurin - head of the Department of Urology at ZSMU, Doctor of Medical Sciences, Professor;

Y.S. Kolomoets - assistant professor of urology department of ZSMU, candidate of medical sciences.

Reviewers:

O. V. Kapshitar - professor of the department of general surgery and post-graduate surgical education of ZDMU, doctor of medical sciences, professor;

V. I. Pertsov - head of the department of disaster medicine, military medicine and neurosurgery of the State Medical University, doctor of medical sciences, professor.

Bachurin H.V., Kolomoets Y.S

Traumatic injuries of the organs of the urinary and male genital system:
educational manual / H.V. Bachurin, Y.S. Kolomoyets. –
Zaporizhzhia: ZSMU, 2023. – 106 p.

The educational manual for students of IV courses of the II international faculty, majoring in "Medicine", presents theoretical material by topic, practical tasks and test control of knowledge.

UDC 616.6(075.8)

© H. V. Bachurin, Y.S. Kolomoets, 2023
© Zaporizhzhia State Medical University, 2023

Content

Preface.....	4
Conventional abbreviations.....	5
SECTION I. Traumatic injuries of the urinary organs and the male genital damage to organs of the genitourinary system.....	6
1.1. Injuries of the urinary system.....	7
1.2. Closed kidney damage... ..	8
1.3. Open damage to the kidneys.....	15
1.4. Damage to the ureters.....	21
1.5. Bladder injuries... ..	26
1.6. Injuries of the urethra... ..	29
1.7. Injury of genitourinary organs.....	34
SECTION II . Emergency care in urological diseases.....	64
2.1. Renal colic.....	65
2.2. Hematuria	66
2.3. Anuria	69
2.4. Acute urinary retention.....	71
SECTION III . Interrelation of urinary system diseases with diseases of other systems and organs.....	83
3.1. Lung condition in some kidney diseases	83
3.2. Skeleton condition in diseases of urinary tract organs	84
3.3. The state of the vascular system in kidney diseases.....	85
3.4. Kidneys in patients with diabetes.....	86
SECTION I V. Radiation diagnostics in emergency urology	87
4.1. Kidney damage.....	90
4.2. Bladder damage.....	92
Recommended literature.....	103

PREFACE

In the higher medical educational institution of the III - IV levels of accreditation, the training system provides for a fairly significant percentage of independent work by students of IV courses of the II international faculty, majoring in "Medicine", approved by the Ministry of Health of Ukraine. Precisely because of this, there was a need to write a teaching and methodical manual, which is compiled in accordance with the educational and qualification program and illuminates and explains the diagnosis and treatment of traumatic injuries of the urinary organs and the male reproductive system, which, unfortunately, are taught to students of medical faculties in a rather concise manner.

The main feature of this study guide is precisely that it was developed in accordance with the typical curriculum of the study discipline "Urology" for students of the IV courses of the II international faculty, majoring in "Medicine".

The manual highlights problematic issues related to injuries of the genitourinary system, as well as discusses modern methods of emergency radiodiagnosis of diseases and injuries of the genitourinary system, the main principle of which is to obtain maximum information using the minimum number of methods. Not only urologists, but also doctors of other specialties have to diagnose, provide first aid and carry out further treatment for injuries of the organs of the urinary system. Since the life and health of the affected person depends on the correct and timely diagnosis and treatment, the study of this topic by future doctors should be considered necessary.

In the manual, most of the illustrative material is created by the authors. Tasks for test control can be used during extracurricular and classroom training.

CONVENTIONAL ABBREVIATIONS

- EU - excretory urography
- CT - computer tomography
- MRI - magnetic resonance imaging
- UBJ - ureteric-bladder junction
- USE - ultrasound examination
- CRF- chronic renal failure
- CBS - cup-bowl system

SECTION I
TRAUMATIC INJURIES OF THE URINARY ORGANS
AND THE MALE GENITAL SYSTEM

Not only urologists, but also doctors of other specialties have to diagnose, provide first aid and carry out further treatment for injuries of the organs of the urinary system. Because the patient's life and health depend on correct and timely diagnosis and treatment.

Purpose: to study the mechanism, classification of symptomatology, methods of diagnosis, provision of direct medical care, treatment, examination of work capacity in case of traumatic injuries of organs of the urinary system.

Didactic purpose:

1. To study classification, symptomatology, methods of diagnosis and treatment of injuries of kidneys and ureters.
2. To study the classification, symptomatology, methods of diagnosis and treatment of bladder injuries.
3. To study the classification, symptomatology, methods of diagnosis and treatment of urethral injuries.
4. Teach students to properly provide first aid for injuries of the urinary system.

Teach students to determine indications for surgical treatment of injuries.

The student should be able to: Form skills, master, practice skills, form professional skills, learn the ability to use knowledge independently, form a clear idea of the sequence of actions, consolidate known methods of action, involve in creative activities, master the methodology of instrumental research, acquire skills in the interpretation of laboratory and instrumental research.

1.1. Injuries of the urinary system

The idea that kidney and ureteral trauma is rare is rejected by daily clinical practice.

In peacetime, closed kidney injuries predominate. According to Ya.S. Shostak (1984) reported 6-7 subcutaneous injuries of this organ for one open kidney injury. H.S. Grebenshchikov and I. A. Krivorotov (1986), studied 1,533 patients with injuries to the pelvis and transverse region, and came to the conclusion that 46.7% of the damage was to the kidneys and ureters.

Classification of kidney and ureter injuries.

A large number of various classifications of damage to the kidneys and ureters are known. Most of them exist on the basis of pathological and anatomical changes that occur as a result of injuries (S.P. Fedorov, 1925, V.A. Horash, 1940), others are based on clinical manifestations of kidney damage (Orit et al., 1960), the third - on radiological signs of injuries (Norvard, 1960), the fourth - according to clinical and radiological data (Dobrovolsky E.L., 1968). It is necessary to know that, depending on the massiveness and localization of injuries, the following types of kidney damage are distinguished:

- 1) damage to the tissues surrounding the kidney and rupture of its fibrous capsule
- 2) subcapsular rupture of the renal parenchyma
- 3) total rupture of the kidney (with damage to the pelvis and calyx)
- 4) crushing of the kidney
- 5) separation of the kidney
- 6) kidney contusion (stroke)

1.2. Closed kidney damage.

Closed kidney damage has been known since ancient times.

The systematic study of these damages began at the turn of the 19th and 20th centuries (FA Rein, 1994).

The frequency of subcutaneous kidney injuries at the beginning of the 20th century. was 0.03-02% in relation to all surgical patients (Y.O. Alksne, 1928). 3, a tendency to their increase in peacetime was determined, and by the beginning of the 60s, closed kidney injuries were noted in 1-1.5% of all surgical patients (II Akhundov, 1960).

The mechanism of subcutaneous kidney injury is complex and caused by many factors. Among them, the force and direction of the blow, the place of its application, the anatomical position of the kidney, its physical qualities, the development of muscles, subcutaneous fat and paranephric tissue, the degree of intestinal filling, intra-abdominal pressure, etc., are important. Subcutaneous kidney damage in peacetime occurs most often as a result of direct trauma, a blow to the lumbar region, falling on a solid object, crushing. In addition, damage to the kidney can also be caused by indirect action (impact): falling from a height, hitting the whole body, jumping, etc.

In these cases, the force of the blow causes a sudden and very strong shock to the kidney and its organs, contraction of the muscles of the abdominal wall and diaphragm. The interaction of these factors causes the strengthening of the kidney and its damage by the ribs or transverse processes of the vertebrae. In addition, with the impact force, in some cases, a hydraulic action occurs due to an increase in the pressure of the liquid (blood, urine) in the kidney. In some cases, in the presence of pathological changes in the kidneys (hydronephrosis, pyonephrosis), damage to the organ occurs even with a minor injury. Cases of kidney rupture with nephrolithiasis are described. A special type of closed injuries of the kidneys should include their damage during instrumental examination of the right urinary tract. When performing

retrograde pyelography, as a result of rough manipulations, there may be tears of the mucous membrane of the cups in the area of their fornices with the occurrence of pelvic-renal reflux (A.Ya. Pitel, 1959).

Clinical picture.

Clinical manifestations of kidney injuries are very diverse and depend on the nature of the damage. With minor injuries, only minor pains in the lower back and microhematuria are noted. The general condition of the patient remains satisfactory. In such cases, it speaks of a kidney attack. With severe injuries accompanied by shock or bleeding, the patient's condition is severe and in some cases a rapid fatal outcome is possible.

In the first hours after the injury, the severity of the victim's condition is determined not only by the nature of the anatomical damage to the kidneys, but also by the disturbance of the surrounding tissues and organs. This includes damage to the organs of the abdominal cavity and chest, internal bleeding, bone fractures, and more. According to I.M. Talman (1939), shock with isolated kidney damage is a relatively rare phenomenon. Long-term shock usually indicates accompanying damage to other organs.

Significant bleeding from several organs, which sometimes accompanies the injury, can lead to collapse. However, shock and collapse are not pathognomonic for closed renal injuries. Against the background of a severe general condition, characteristic signs of kidney damage can be erased, which makes it difficult to establish a correct diagnosis. On the other hand, severe renal symptoms sometimes occur with minor kidney damage. In this regard, the clinical picture of a closed kidney injury does not always correspond to the degree of anatomical destruction of the latter.

Kidney injury is characterized by a triad of clinical symptoms, pain in the transverse region, its swelling, hematuria.

Pain in the lumbar region is noted in 95% of isolated injuries and in 100% of kidney injuries. Pain occurs as a result of a number of reasons: damage to the tissues surrounding the kidney, stretching of the kidney capsule, pressure on the parietal abdomen, growing hematomas, blockage of the ureter with blood clots. Sometimes pain in the lower back is a consequence of fractures of the lower ribs or indicates combined injuries of the kidneys from damage to the organs of the abdominal cavity. The nature of the pain can be different: dull, sharp, and aching with irradiation in the groin area. Many patients, especially children, complain of dull pain in the corresponding half of the abdomen. The pain lasts from one to two days to several weeks, gradually subsiding. An important symptom of kidney damage is swelling in the transverse or subcostal area. It is due to the accumulation of blood (hematoma) or blood together with urine (urohematoma) in the renal and extraperitoneal tissue. Swelling rarely occurs on the first day after the injury, more often it appears on the 2nd or 3rd day. Large hematomas (urohematomas) can spread from the diaphragm to the pelvis along the retroperitoneal tissue along the exit and descending part of the large intestine, and after 2-3 weeks they are occasionally identified in the scrotum and on the thigh. Successively, urohemitomas dissolve very slowly. However, swelling is not always well defined. Contraction of the abdominal and lumbar muscles on the side of the injury makes it difficult to detect. A hematoma may not be present when the outflow of urine is preserved through the ureter or when blood and urine enter the abdominal cavity through a tear. Therefore, swelling is not often diagnosed. The most essential and partial sign of kidney damage is hematuria. According to literature data, the frequency of hematuria varies from 60 to 98% with subcutaneous kidney injury. The duration of hematuria can be different. As a rule, it lasts up to 4-5 days, in some cases 2-3 weeks or more. The duration of hematuria is determined, as a rule, by the degree of kidney damage.

The intensity of hematuria with kidney injury is also different. Short-term macrohematuria usually does not cause bleeding in patients, while long-term and

intense macrohematuria can cause severe anemia and sometimes be a threat to the patient's life. In such cases, macrohematuria is a reason for surgical intervention.

In case of kidney damage, in addition to the listed symptoms, there are often signs that, although not typical for the clinical picture of kidney injury, are no less important for establishing a diagnosis. These include: dysuric phenomena, pain in the lower abdomen, symptoms of abdominal irritation, as well as disorders of the gastrointestinal tract.

Painful urination in cases of kidney injury is caused by blood admixture in the urine, often with clots. A large number of blood clots can lead to urinary retention and cause bladder tamponade. Sometimes dysuria is a consequence of renal colic.

Among the other symptoms of a closed kidney injury, the following are often noted: abdominal distension, absence of bowel obstruction, presence of dullness in the soft parts of the abdomen (with combined injuries) and others.

Insignificant blood loss by patients in the first hours after the injury does not manifest itself clinically.

Diagnostics.

Based on the patient's complaints, history and clinical signs, the fact of kidney damage is usually established. At the same time, determination of the type and nature of kidney injury often presents known difficulties and is possible only after a long-term urological examination. This, in particular, is evidenced by the data on the ratio of primary diagnoses and diagnoses established in medical institutions. Errors sometimes reach 9.4%.

The methods of examining patients are used in each case, depending on the indicators of their application and the specific capabilities of this medical institution.

The majority of domestic and foreign authors are cautious about carrying out cystoscopy and chromocystoscopy in case of fresh kidney injury. These methods often make it possible to detect the state of damage and establish the functional capacity of the kidney.

It is advisable to start the X-ray examination with a survey image of the organs of the urinary system. An overview picture allows you to establish or exclude bone damage, the presence of stones in the kidneys or urinary tract, determine in some cases a transabdominal hematoma, and sometimes find a clear shadow of the second kidney.

The swelling or absence of a shadow of the edge of the lumbo-iliac muscle in the early period after the injury is usually interpreted as a sign of retro-abdominal hematoma.

More valuable information about the condition of the kidneys can be obtained by dividing urography. It can be used for the diagnosis of closed kidney injuries at any time after the injury. In the early period, she gives a number of certificates about the type of damage, about the anatomical and functional state of the damaged and ditch kidney Separating urography often makes it possible to judge the severity and localization of injuries. This method is relatively simple and the most physiological.

In recent years, information on the possibility of using renal angiography in closed kidney injury has been published in domestic and foreign literature (N.A. Lopatkin, 1961, 1963).

Today, certain attention is paid to radioisotope research methods in case of blunt kidney injury. Radioisotope renography is safe for the victim, can be used repeatedly at any time after the injury, and allows you to dynamically monitor the functional state of the kidneys. Scanning in cases of preservation of the function of the damaged kidney can indicate the localization of the damage. These studies, as well as renal angiography, are a good additional method to determine the correct diagnosis.

If excretory urography is relatively often used by doctors to diagnose fresh closed kidney injuries, the same cannot be said about retrograde pyelography, which most domestic urologists refrain from because of the danger of increased bleeding and

kidney infection. More often, this is a valuable study in a number of cases for the diagnosis of subcutaneous kidney damage. Retrograde pyelography can be performed at any time after an injury, if the patient's condition allows and there is an opportunity and data for its performance. The study should be performed with careful observance of sterility and the use of antibiotics administered both parenterally and together with a contrast agent.

Treatment:

The majority of modern urologists adhere to a conservative method of treating fresh kidney injuries, not excluding operative treatment in certain cases. Conservative treatment of isolated closed kidney damage is indicated in those cases when the general condition of the patient is satisfactory, there is no profuse hematuria, symptoms of internal bleeding, signs of growing hematoma and urinary infiltration. It consists in the following:

- 1) bed rest for 10-15 days,
- 2) prescription of painkillers and hemostatic agents,
- 3) prescription of drugs that prevent or limit the development of rough scar tissue (lidase, corticosteroids).
- 4) prescription of antibiotics,
- 5) constant medical control of patients or, if necessary, it was possible to immediately carry out operative actions.

After the disappearance of hematuria and pain sensations in the transverse region from the side of the damaged kidney, the restoration of kidney function, a satisfactory general condition gives the right to assume that clinical recovery has occurred. Experience shows that most closed kidney injuries do not require surgery and end well with conservative treatment.

The main evidence for relatively immediate surgical intervention in case of fresh kidney injuries is the increase of internal bleeding, the rapid increase of

perirenal hematoma (urohematoma). Intense and long-lasting hematuria with worsening of the general condition and a combination of kidney damage with damage to the intra-abdominal organs.

Before the operation, even if the patient's condition is satisfactory, it is recommended to start a drip transfusion of blood or infusion of blood substitutes, solutions, continuing it during the operation, and often in the postoperative period. Transfusions of massive doses of blood are very important in the case of combined damage to the kidneys, internal organs, and pelvic bones, when the victim loses a significant amount of blood that has spilled into the abdominal cavity, peritoneum, and mouth and pelvic tissue. It is necessary to operate on patients after bringing them out of a state of shock, and if the latter fails in the near future, and the patient's condition continues to deteriorate, then I perform the operation without interrupting the active shock therapy.

With kidney damage, various operative approaches are possible. Lumbar extra-abdominal incision is often still used in cases of isolated kidney damage. If there is a risk of simultaneous damage to the kidneys and organs in the abdominal cavity, a laparotomy is also performed, usually a midline one.

After seeing the damaged kidney, the surgeon determines the nature of the surgical intervention. Some surgeons are in favor of expanding the indications for nephrectomy, others seek to preserve the kidney and recommend organ-sparing operations.

Indications for early nephrectomy are crushing of the kidney, as well as damage to its vascular pedicle. Indications for organ-preserving operations on the kidney are ruptures and detachments of one of the poles of the kidney, single cracks and ruptures of the body of the kidney, as well as its fibrous capsule, damage to a

single kidney, damage to one of the kidneys due to pathological changes in the other, simultaneous damage to both kidneys.

Most often, organ-preserving operations are used: tamponade of a kidney wound, suturing of a kidney wound, resection of one of the poles of the kidney, application of a renal fistula (fistula), ureteropyelonestomy, and others.

In those cases when an operation should be decided immediately for a damaged kidney - without the data of a special urological examination, one should remember the possibility of damage to a single kidney or a horseshoe kidney, and therefore before cutting off a kidney in the existing clinical situation, it is necessary to make sure in preservation of the function of the second kidney, for this during laparotomy, palpation of the other kidney in the abdominal cavity is used, and to determine its functional capabilities, an indigo carmine test is performed on the operating table when the ureter of the damaged kidney is compressed, which must be excised.

At the beginning of the operation, the wound in the lumbar region is sutured and carefully drained .

In the post - operative period, the entire complex of medical actions should be aimed at preventing complications. It is advisable to administer cardiac drugs, blood transfusions, and administer fluids. Intravenous injections of hypertonic fluid are very useful for intestinal paresis. It is necessary to follow the daily diet , especially in the mornings and afternoons.

1.3. Open kidney damage.

In peacetime, open kidney injuries are rare compared to closed ones, but even in past wars, they were rarely diagnosed and hardly covered in the press. Suffice it to say that for the entire Russo -Japanese war of 1904-1905, only 4 cases were described. Therefore, many surgeons and urologists have formed the opinion that open damage to the kidneys, even in wartime, is a rare phenomenon. However, this is

not entirely true. For example, autopsy data of 1,500 casualties on the battlefield in the First World War showed that 4.9% (A. Aksne, 1919) of them had kidney damage. VL. By the end of World War I, Horash (1922) had already collected 622 cases of kidney injuries, including 24 of his observations.

The most objective frequency of kidney damage is reflected by the figures based on the materials of the medical and sanitary battalions (M. N. Dukova, 1965), where these damages during the Great Patriotic War were recorded from 0.35 to 0.7% in relation to the wounded.

Due to anatomical features: the proximity of the organs of the abdominal cavity and chest, spine, large vessels, kidney injuries are often combined (A.P. Frumkin, 1940 -40.8%), which determines their severity and a large number of serious and threatening complications (bleeding, shock, etc.). Frumkin A.P. found out that only 4 of 27 wounded in the kidney had isolated injuries.

Pathological anatomy.

Changes in the damaged kidney, observed both immediately after the injury and later, are very diverse. It depends primarily on the nature of the weapon (bullet, shrapnel, knife), as well as on the conditions in which the injured person was at the time of injury. Knife wounds more often have the form of linear breaks, the length of which can be located both radially and transversely in relation to the renal vessels. The last circumstance is of great importance. Since the closer the wound is to the renal pedicle, the greater the risk of damage to the main vessels and the larger the area of infarction with subsequent suppuration and melting.

Even deeper anatomical changes occur with gunshot wounds. Due to tissue contusion around the wound channel, which prompted many surgeons at the time (S.P. Fedorov, 1924, A.L. Vasiliev, 1949) to recommend primary nephrectomy for kidney injuries.

In their main mass, kidney injuries are classified as serious with full justification. Complete crushing of the organ is quite common.

The following types of open kidney damage are distinguished: 1) injury to the perirenal tissue, 2) injury to the cortical substance of the kidney, 3) injury to the medulla of the kidney and pelvis, 4) injury to the large vessels of the kidney. Combinations of these types of damage are most often observed.

Clinical picture and symptoms.

The clinical picture of kidney injuries in the early period is a complex complex of tissue, vascular, nervous disorders of both local and general nature and disorders of the urinary organs. The isolated or combined nature of the damage has a great impact on these disorders. In the latter case, symptoms of damage to organs of the abdominal cavity, chest, spine, spinal cord, and others often come to the fore.

The main symptoms of open kidney damage are:

hematuria,

pain in the kidney area,

urohematoma,

localization of wounds and direction of the wound canal,

leakage of urine from the wound.

However, the last symptom is very rare, although it is the most reliable (2% according to P. G. Divnenko, 1954).

If kidney injuries are suspected, the method proposed by A. Ya. Pytelem and I. P. Pogorelko (1964) for determining urine in bloody secretions from wounds using a bromine solution can be used. When splicing with this solution a bandage impregnated with wound discharge, in the presence of urine, bubbles of gas (nitrogen) appear.

More often, blood and urine flow into the perirenal tissue and a urohematoma is formed due to them. However, it can be observed in an average of 29.3%. Since in most patients, kidney injuries are combined, therefore blood and urine from the wounded organ enters the abdominal cavity and pleural cavity and, to a lesser extent, into the peritoneum.

Hematuria is the leading and at the same time the most frequent and early symptom of kidney injury. According to the observations of various authors, it occurs in 87.6-94% of the wounded. Blood in the urine often appears quite quickly after the injury, already during the first urination, while there is often a large amount of blood clots in the urine, which can lead to tamponade of the urinary bladder and retention of urine. With injuries of the kidneys, as well as with their closed injuries, the degree of hematuria cannot be used to judge the type and extent of destruction of the injured kidney.

On the contrary, the most severe injuries of the renal portal may not be accompanied by the appearance of blood in the urine as a result of the destruction of the vessels of the renal pedicle, and small tears of the renal parenchyma sometimes lead to profuse hematuria.

Pain in the lumbar region varies in intensity and depends on the condition of the injured person and the degree of damage not only to the kidney, but also to other organs. Sometimes pain in the form of renal colic can be observed as a result of blockage of the ureter by a blood clot. The pain is caused by the protective tension of the abdominal muscles, which is observed even with isolated kidney damage. But still, the earlier the tension appears and the stronger it is expressed, the more reason to suspect simultaneous damage to the organs of the abdominal cavity.

According to L. I. Dunaevskiy, if the injured area is divided in front by the nipple line, behind by the spine, above by the costal arch, below by the wing of the iliac bone, one should always suspect kidney injury.

A kidney injury is mostly a serious injury. The seriousness of the condition of the wounded causes a lot of blood loss and shock. In comparison with a closed injury, shock is much more common in kidney injuries, which is primarily due to the connective nature of most kidney injuries. The amount of blood loss is judged primarily by the general condition of the wounded, the pulse rate, the presence of cold

in the body, and to a lesser extent by the degree of hematuria (S.P. Fedorov, R.M. Fronshtein).

Diagnostics.

If you do not count the leakage of urine from the wound, there is no pathognomonic sign for kidney injury. Therefore, surgeons often encounter great diagnostic difficulties.

Recently, there are more and more reports in the literature about the importance of radiological methods for clarifying the type and degree of kidney damage, it is recommended to start radiological studies with an overview picture and excretory urography, and it should be done immediately after removing the injured from shock, as later will interfere with intestinal bloating. Also, as with a closed injury of the kidney, isolated urography, being a relatively safe method, at the same time, in a number of cases, is able to indicate the morphological and functional state of both the injured and healthy kidney. Excretory urography should not be used if the patient's blood pressure is significantly reduced (below 100 mmHg). The same can be said about chromocystoscopy. Any transurethral diagnosis is generally inappropriate for a wounded person who is in shock.

X-ray examination, if there are opportunities and indications, always begins with the performance of a survey X-ray and secretory urography, by the way, late urograms, which are carried out after 1-2 hours, and more after the injection of a contrast agent into a vein, can be useful. On the urograms, in addition to the decrease in the function of the damaged kidney, it is possible to find a contrast agent injection, both in the perirenal tissue and in the middle of the abdominal cavity. Sometimes all kinds of changes and deformations of the pelvis and cups are determined (filling defects, amputation of the cups).

When deciding the fate of the kidney during surgery, it is necessary to remember that in 0.1% of cases, injury to the single and horseshoe-shaped kidney may occur. Therefore, it is necessary to check the presence and functional state of the

opposite kidney. This is done according to the method discussed above, which is identical to closed kidney injury.

Treatment.

Patients with kidney injury, as a rule, are subject to operative treatment. Conservative treatment is indicated only for isolated injuries without significant destruction of tissues, with a satisfactory condition of the wounded and moderate hematuria.

In such cases, calcium chloride, Vikasol, transfusion of small doses of canned blood, aminocaproic acid are prescribed for hemostatic purposes. For the prevention of inflammatory phenomena in the wound, sulfonamides and drugs of the nitrofurantoin series.

In addition, it is necessary to prescribe a high-calorie diet, vitamins, and monitor bowel activity.

If in the course of conservative treatment, signs appear near a renal hematoma, urinary effusion or phlegmon, hematuria intensifies, then in such cases, appropriate surgical intervention should be applied immediately.

A number of authors (I.M. Epshtein) believe that microscopic hematuria lasting more than 10-12 days is evidence for surgical intervention. The nature and volume of surgical intervention in these cases is determined during the kidney revision.

The frequency of combined kidney injuries forces surgeons to use laparotomy more often than lumbotomy. In some cases, thoracotomy is also used.

Revision of the injured kidney and adjacent abdomen during the operation is a mandatory element of surgical treatment of the wound. Non-observance of this rule may entail negative consequences. In the case of severe renal bleeding and profuse hematuria, regardless of the direction of the wound channel, it is necessary to first expose the kidney with an ordinary lumbar incision and stop the bleeding, and then subject the wound to surgical treatment.

It is not easy to solve the question of which operation to perform on the kidney - nephrectomy or organ-preserving.

A number of factors influence the choice of the operation method, namely: the nature of the kidney damage, the time that has passed since the injury, the combination of the kidney injury with the injury of other organs, the possibility of treating the injured person from beginning to end in one medical institution, and the qualifications of the operating surgeon.

Indications for early nephrectomy in both isolated and combined kidney injuries are crushing of the entire renal parenchyma, multiple deep cuts and wounds of the body of the kidney penetrating into the pelvis, crushing of one of the poles reaching the renal gate, as well as damage to the main vessels of the renal pedicle.

Among organ-preserving operations, suturing of kidney wounds and resection are most often used.

Indications for such operations are as follows: damage to the fibrous capsule, surface cracks of the parenchyma, marginal defects of the kidney, injury to the poles of the kidney. Any surgery for kidney injury should end with drainage of the perirenal bed. When the kidney cavities are injured, a nephrostomy or pyelostomy tube should be left for 7-14 days. Through this tube, it is easier to evacuate blood clots and local antibiotics can be administered in the postoperative period.

Complication.

Depending on the time that passed from the moment of kidney injury to the appearance of complications, the latter are divided into early and late. Early ones include bleeding and traumatic shock. To late - inflammatory processes in the kidneys and urinary tract, hydronephrosis, secondary renal bleeding, kidney infarctions, anuria, renal sinuses, kidney tumors, etc.

1.4. Damage to the ureters.

Various injuries of the ureters are observed in closed injuries, gunshot, stab wounds, during operative actions (unplanned) on the organs of the extra-abdominal space, abdominal cavity and small pelvis, and endurethral manipulations.

Closed injuries of the ureters.

This type of ureteral damage is relatively rare. The largest diameter, good mobility, elasticity and depth of the ureters make them inaccessible for this type of injury.

In the case of closed injuries of the ureters, their wall is completely or partially destroyed or more or less significantly crushed, which leads to necrosis or the formation of a stricture. I. P. Shevtsov (1972) described two cases where strictures formed at the site of impact after ureters were struck, which led to the development of hydronephrosis.

Open injuries of the ureters.

Before the Great Patriotic War, about 40 gunshot injuries to the ureters were described in the literature.

During the Great Patriotic War, according to I. M. Epshtein (1947), ureteral injuries in relation to kidney lesions accounted for 9%, and among genitourinary organ injuries, they accounted for 0.2% to 1.2%.

Injuries to the ureters are almost always combined. They are accompanied by damage to various parts of the colon and small intestine, vessels of the abdominal cavity, pleura, lungs, spine, pelvic bones, liver, spleen, pancreas, stomach, duodenum, kidneys, bladder.

Isolated gunshot injuries to the ureters are extremely rare. Both the left and right ureters are damaged equally often. The pelvic region is mainly affected.

Puncture - cut damage to the ureters.

Similar injuries of the ureters are very rare and have isolated observations in the literature. L. I. Slyashevich (1934) reported a combined injury of the right ureter and inferior vena cava. I. P. Shevtsov (1972) described a case of a stab wound of the upper third of the ureter in combination with colon injuries.

Damage to the ureters during surgical interventions.

This includes the so-called accidental or unintentional damage to them, during various surgical interventions, mainly during gynecological operations.

According to various authors, the frequency of unintentional damage to the ureters during gynecological operations varies widely and depends on the nature of the pathological process (atypically located fibroids, intraligamentary tumors of the ovary) and the radicalism of the surgical intervention. Some authors note that the frequency of damage to the ureters during gynecological operations reached 10%. They note that injuries are diagnosed only in 37.4% of cases. In 25.2% of the cases of damage to the ureters that occurred earlier, they are found later in the form of stricture and hydronephrosis.

If accidental damage to the ureter during surgery remains unnoticed, especially when it is localized in the prostate: ureteral fistulas, periureteritis, and structures causing the development of hydronephrosis occur.

The prevention of such damage consists in the following: insertion of catheters into the ureters before surgery, careful and careful separation of the ureter from the adhesion, ligation of blood vessels, taking the ureter on a handle, etc.

Damage to the ureters during endourethral manipulations.

For the purpose of diagnosis and carrying out various medical measures, various ureteric catheters, loops for the removal of stones, bougies, etc. are inserted into the ureters.

The use of catheters and forced use of instruments, especially in the case of pathological changes in the ureters (ureteritis, fixed bends, atony, stones) can lead to the appearance of abscesses, lacerations, perforation of the ureter wall and even its separation from the bladder.

Clinical picture and symptomatology of ureters.

Fire and puncture wounds and cut wounds of the ureters may not manifest themselves clinically at first. Moderate hematuria is observed only in approximately half of the wounded, which is noted once when the ureter is completely ruptured. There is no leakage of urine from the injured channel in the first days. It usually starts on 4-12 days after the injury. When the ureter is tangentially injured, the urinary fistula is intermittent, which is explained by the temporary restoration of the ureter's patency. When the abdomen is damaged, urine enters the abdominal cavity, and the leading symptom in this case will be peritonitis. If the outflow of urine to the outside is difficult and it does not enter the abdominal cavity, fatty tissue seeps through it, urohematoma, urinary sinuses, urinary intoxication, phlegmon and sepsis develop. Signs of subcutaneous damage to the ureters are pain similar to attacks of renal colic, hematuria and rapid tumor formation in the corresponding half of the abdomen or lumbar region (false hydronephrosis).

Diagnostics

Recognizing fresh damage to the ureters is particularly difficult. Severe combined injuries first of all attract the attention of surgeons, as a result of which injuries of the ureters are often overlooked. It is difficult to diagnose its damage even during the first surgical treatment.

For the diagnosis of ureteral damage, especially in the early days after an injury, secretory urography is successfully used, which will confirm the state and degree of patency of the ureter, the level of its damage and swelling, contrast material into the surrounding tissues.

Chromocystoscopy allows you to determine the condition of the walls of the urinary bladder, establish the patency of the ureters. In addition, indigo carmine can be released from the wound canal.

Catheterization of the ureter and retrograde pyeloureterography can be used for diagnosis, supplementing fistulography as indicated. In such cases, it is necessary to add antibiotics to the contrast medium.

For the method of filling the bladder with a dyed liquid (methylene blue, indigo carmine) is used for the purpose of differential diagnosis between injury to the ureters and bladder. In the event of injury to the bladder, stained fluid will be released from the urinary fistula, and in case of damage to the ureter, unstained urine will be released from the fistula.

All of the above studies allow you to reliably establish the side of the damage, the nature of the damage and draw up the correct treatment plan.

Treatment.

Depending on the nature of the damage to the ureter and the degree of violation of its integrity, the treatment can be carried out by conservative and operative methods. Conservative treatment is usually carried out in case of ureteral damage during endurethral manipulations and subcutaneous injuries in case of blows and tears of the ureteral wall without violation of the integrity of all its layers.

This treatment consists in the appointment of antibiotics, heat procedures, ureteric enlargement, as well as therapy aimed at preventing the development of periureteritis and strictures (vitreous body preparations, lidase, corticosteroids).

Methods of operative treatment are very diverse. Among them are means aimed at eliminating the consequences of the violation of the integrity of the ureter, as well as methods of restoring the normal patency of the upper urinary tract and the outflow of urine from the kidney.

In case of incomplete rupture or tangential injury of the ureter, as well as when it is damaged during surgery, knotted catgut sutures are applied to the wound of the ureter in such a way as to prevent narrowing of its lumen. Drainage and a tampon are brought to the ureter. This is especially necessary for injuries to the ureters in the pelvic region, as they heal very poorly and are often complicated by urinary fistulas. In some cases, when the wall of the ureter is damaged in a small area with good drainage of the wound, treatment can be carried out without surgical intervention, by introducing a urinary catheter into it.

In those cases when the injury of the ureter is diagnosed late, patients develop urinary sinuses, phlegmons and urinary fistulas. In the region of the ends of the damaged ureter, strictures, periureteritis and, as a result, hydronephrosis, hydroureter are formed. In such situations, the opening and drainage of urinary cysts, the placement of renal masses in severe condition of the patient, and the choice of operation is nephrectomy.

In case of accidental ligation of the ureters in gynecological practice, it is necessary to expose the required area of the ureter and remove the ligature from it.

Experimental studies and clinical observations show that by eliminating the complete obstruction of the ureter, it is possible to save the kidney and restore its function, if the operation is performed within the first month after the obstruction to the outflow of urine.

In those cases when the ureters are damaged along the way and its ends can be inserted without tension, the ideal method of restoring normal patency is urinary anastomosis.

When the ureter is damaged in the lower third and it is impossible to restore its integrity with the help of a suture, a roystoneostomy is usually performed.

Currently, attempts are being made to replace large areas of the ureters with intestinal transplants or synthetic materials. However, the final resolution of these issues requires further and in-depth research.

1.5. Bladder injuries.

In practice, they use the classification of V.L. Yampolsky:

1. In relation to the abdominal cavity (intra-abdominal, extra-abdominal, mixed).
2. By localization (body, bottom, top, triangle, neck).
3. By type of damage (closed - impact, incomplete rupture, complete rupture, two-stage rupture, open - impact, complete, tangential, through, blind injury).

Closed damage.

The frequency is from 3.5 to 16.6% of closed abdominal trauma.

With extra-abdominal there is always a fracture of the bones of the pelvis, with intra-abdominal - rarely. The pubic bone is most often damaged.

Mechanism of injury.

- 1) With intra-abdominal - an increase in hydrostatic pressure with a maximally filled bladder.
- 2) Extra-abdominal - crushing with heavy objects, direct blows to the pelvis.

Pathological anatomy.

Pathological processes develop not only in the bladder, but also in those organs and tissues that are subject to urinary infiltration. With intra-abdominal - peritonitis, with extra-abdominal - phlegmon of pelvic tissue.

Symptoms and clinic.

- a) General symptoms.
- b) Symptoms of bladder damage.
- c) Symptoms of damage to the bones of the pelvis and nearby organs.

With ectopic - pain in the suprapubic region, retention of urine, frequent urges to urinate. Most often - false urges with the release of drops of urine with blood. As the paravesical urohematoma grows, the pain increases, muscle tension increases. A dull sound without clear boundaries, swelling.

Then urinary phlegmon, urosepsis. With minor damage, urination persists. Often hematuria.

Three periods:

- 1) appearance of the first symptoms
- 2) spread of urinary infiltrate
- 3) development of urinary phlegmon

With intra-abdominal - signs of rupture of an intra-abdominal organ (shock, collapse).

The earliest and most frequent symptom is pain, first in the suprapubic region, then spread throughout the abdomen.

Violations of urinary flow - frequent and false urges. The combination of urinary retention with the development of peritonitis is an important sign.

Objectively - tension, swelling, soreness, increasing signs of intoxication, dullness in the suprapubic region and in soft cities.

Diagnostics

History, objective data, instrumental and X-ray examination (novocaine blockade).

- 1) The above data are taken into account.
- 2) Diagnostic catheterization: with extra-abdominal urine there is no or little blood, with intra-abdominal - a lot of liquid with protein. Zeldovich's symptom
- 3) Cystoscopy.
- 4) Retrograde cystography: allows to detect penetrating from non-penetrating recumbent, intra-abdominal from extra-abdominal, to reveal the location of the inlets, place of rupture

Treatment.

In case of incompletely closed injuries, the patient does not need special treatment. Only in cases of urinary obstruction, a permanent catheter is inserted.

In case of complete damage, the treatment is only surgical. Intra-abdominal: laparotomy, revision, wound suturing, cystostomy or permanent catheter.

Extra-abdominal: wound suturing, Bualsky-McWhorter drainage, cystostomy or indwelling catheter.

Open damage.

- | | |
|---------------------|--------------|
| * fire (rarely) | * mixed. |
| * cut and pierced | * tangential |
| * during operations | * through |
| * intra-abdominal | * blind. |
| * extra-abdominal | |

Open lesions are usually combined. Artificial injuries are most common during childbirth and gynecological operations.

Symptoms: urinary disorders and hematuria.

Excretion of urine and wound passage - in 11%. Localization of the entrance and exit of the wound.

Diagnostics: catheterization, filling of the urinary bladder with indigocarmine solution, cystoscopy, cystography.

Treatment: urgent, operative - wound suturing, cystostomy, drainage.

1.6. Injuries of the urethra.

In men - the first place, in women it is extremely rare.

Classification: according to A. A. Rusanov:

- 1) not through,
- 2) through.

Not through (non-penetrating)

- a) internal
- b) interstitial
- c) external.

Through

- a) internal
- b) interstitial
- c) external.

Pathology, pathogenesis.

The nature of the damage, intensity and localization of urinary infiltration is important.

Closed injuries.

Mechanism (pelvic bone fracture, perineal trauma).

Symptoms: dull pain in the perineum, scrotum, sharp - in the urethra, urethrorrhagia, urinary retention, frequent ineffective urge, distended bladder, hematoma, urinary stains on the perineum, scrotum. Bleeding is moderate but significant in case of damage to the cavernous bodies and prostate. Injuries of the membranous and prostatic sections are combined with pelvic bone fracture and are accompanied by shock, bleeding.

Diagnosis: the above data and urethrography.

Treatment.

Antishock treatment, bladder puncture. Treatment methods depend on the patient's condition, the nature of the localization and degree of damage and complications, the duration since the injury. In case of non-penetrating injuries, conservative therapy is indicated: rest, cold, antibiotics, blood-stopping drugs. In case of severe bleeding - pressure bandage. In case of penetrating - urine diversion, stop bleeding, restore the urethra, primary suture, drainage, cystostomy, drainage, primary urethral suture.

Open injuries

Occur mainly in wartime.

Classification:

- | | |
|--------------------|-----------------|
| 1) non-penetrating | 2) penetrating. |
| | a) complete |
| | b) incomplete. |

There are wounds:

- punctures
- cut
- lacerations
- bitten.

Symptoms: acute urinary retention or obstructed urethra, frequent urge, urethrorrhagia, lower abdominal and perineal pain, enlarged bladder, urine discharge from the wound during urination.

With isolated damage the condition is satisfactory, with combined - severe.

Diagnosis.

The data, the direction of the wound course are indicated. To establish the nature, type, localization of the injury, urethrography is performed.

Treatment.

Dealing with shock, anemia, cystostomy,
opening and draining hematoma and urinary leaks,
restoration of urethral integrity.





1.7. Injury of genitourinary organs

Diagnosis

About 10% of all injuries seen in the emergency room involve the genitourinary system to some extent. Many of them are subtle and difficult to define and require great diagnostic expertise. Early diagnosis is essential to prevent serious complications.

Initial assessment should include control of hemorrhage and shock along with resuscitation as required. Resuscitation may require intravenous lines and a urethral catheter in seriously injured patients. In men, before the catheter is inserted, the urethral meatus should be examined carefully for the presence of blood.

The history should include a detailed description of the accident. In cases involving gunshot wounds, the type and caliber of the weapon should be determined, since high-velocity projectiles cause much more extensive damage.

The abdomen and genitalia should be examined for evidence of contusions or subcutaneous hematomas, which might indicate deeper injuries to the retroperitoneum and pelvic structures. Fractures of the lower ribs are often associated with renal injuries, and pelvic fractures often accompany bladder and urethral injuries. Diffuse abdominal tenderness is consistent with perforated bowel, free intraperitoneal blood or urine, or retroperitoneal hematoma.

Patients who do not have life-threatening injuries and whose blood pressure is stable can undergo more deliberate radiographic studies. This provides more definitive staging of the injury.

Special Examinations

When genitourinary tract injury is suspected on the basis of the history and physical examination, additional studies are required to establish its extent.

Catheterization and Assessment of Injury

Assessment of the injury should be done in an orderly fashion so that accurate and complete information is obtained. This process of defining the extent of injury is termed staging. The algorithms outline the staging process for urogenital trauma.

Catheterization

Blood at the urethral meatus in men indicates urethral injury; catheterization should

not be attempted if blood is present, but retrograde urethrography should be done immediately. If no blood is present at the meatus, a urethral catheter can be carefully passed to the bladder to recover urine; microscopic or gross hematuria indicates urinary system injury. If catheterization is traumatic despite the greatest care, the significance of hematuria cannot be determined, and other studies must be done to investigate the possibility of urinary system injury.

Computed Tomography (CT)

Abdominal CT with contrast media is the best imaging study to detect and stage renal and retroperitoneal injuries. It can define the size and extent of the retroperitoneal hematoma, renal lacerations, urinary extravasation, and renal arterial and venous injuries; additionally, it can detect intra-abdominal injuries (liver, spleen, pancreas, bowel). Spiral CT scanning, now common, is very rapid, but it may not detect renal parenchymal lacerations, urinary extravasation, or ureteral and renal pelvic injuries. We recommend repeat scanning 10 min after the initial study to aid the diagnosis of these conditions.

Retrograde Cystography

Filling of the bladder with contrast material is essential to establish whether bladder perforations exist. At least 300 mL of contrast medium should be instilled for

full vesical distention. A film should be obtained with the bladder filled and a second one after the bladder has emptied itself by gravity drainage. These 2 films establish the degree of bladder injury as well as the size of the surrounding pelvic hematomas.

Cystography with CT is excellent for establishing bladder injury. At the time of scanning, this likewise must be done with retrograde filling of the bladder with 300 mL of contrast media to ensure adequate distention to detect injury.

Urethrography

A small (12F) catheter can be inserted into the urethral meatus and 3 mL of water placed in the balloon to hold the catheter in position. After retrograde injection of 20 mL of water-soluble contrast material, the urethra will be clearly outlined on film, and extravasation in the deep bulbar area in case of straddle injury free extravasation into the retropubic space in case of prostatomembranous disruption will be visualized.

Arteriography

Arteriography may help define renal parenchymal and renal vascular injuries. It is also useful in the detection of persistent bleeding from pelvic fractures for purposes of embolization with Gelfoam or autologous clot.

Intravenous Urography

Intravenous urography can be used to detect renal and ureteral injury. This is best done with high-dose bolus injection of contrast media (2.0 mL/kg) followed by appropriate films.

Cystoscopy and Retrograde Urography

Cystoscopy and retrograde urography may be useful to detect ureteral injury, but are seldom necessary, since information can be obtained by less invasive techniques.

Abdominal Sonography

Abdominal sonography has not been shown to add substantial information during initial evaluation of severe abdominal trauma.

Injuries to the Kidney

Renal injuries are the most common injuries of the urinary system. The kidney is well protected by heavy lumbar muscles, vertebral bodies, ribs, and the viscera anteriorly. Fractured ribs and transverse vertebral processes may penetrate the renal parenchyma or vasculature. Most injuries occur from automobile accidents or sporting mishaps, chiefly in men and boys. Kidneys with existing pathologic conditions such as hydronephrosis or malignant tumors are more readily ruptured from mild trauma.

Etiology

Blunt trauma directly to the abdomen, flank, or back is the most common mechanism, accounting for 80 - 85% of all renal injuries. Trauma may result from motor vehicle accidents, fights, falls, and contact sports. Vehicle collisions at high speed may result in major renal trauma from rapid deceleration and cause major vascular injury. Gunshot and knife wounds cause most penetrating injuries to the kidney; any such wound in the flank area should be regarded as a cause of renal injury until proved otherwise. Associated abdominal visceral injuries are present in 80% of renal penetrating wounds.

Pathology. Classification

Early Pathologic Findings

Lacerations from blunt trauma usually occur in the transverse plane of the kidney. The mechanism of injury is thought to be force transmitted from the center of the impact to the renal parenchyma. In injuries from rapid deceleration, the

kidney moves upward or downward, causing sudden stretch on the renal pedicle and sometimes complete or partial avulsion. Acute thrombosis of the renal artery may be caused by an intimal tear from rapid deceleration injuries owing to the sudden stretch.

Hydronephrosis

Large hematomas in the retroperitoneum and associated urinary extravasation may result in perinephric fibrosis engulfing the ureteropelvic junction, causing hydronephrosis. Follow-up excretory urography is indicated in all cases of major renal trauma.

Arteriovenous Fistula

Arteriovenous fistulas may occur after penetrating injuries but are not common.

Renal Vascular Hypertension

The blood flow in tissue rendered nonviable by injury is compromised; this results in renal vascular hypertension in less than 1% of cases. Fibrosis from surrounding trauma has also been reported to constrict the renal artery and cause renal hypertension.

Clinical Findings. Indications for Studies

Microscopic or gross hematuria following trauma to the abdomen indicates injury to the urinary tract. It bears repeating that stab or gunshot wounds to the flank area should alert the physician to possible renal injury whether or not hematuria is present. Some cases of renal vascular injury are not associated with hematuria. These cases are almost always due to rapid deceleration accidents and are an indication for imaging studies.

The degree of renal injury does not correspond to the degree of hematuria, since gross hematuria may occur in minor renal trauma and only mild hematuria in major

trauma. However, not all adult patients sustaining blunt trauma require full imaging evaluation of the kidney. Miller and McAninch (1995) made the following recommendations based on findings in over 1800 blunt renal trauma injuries: Patients with gross hematuria or microscopic hematuria with shock (systolic blood pressure < 90 mm Hg) should undergo radiographic assessment; patients with microscopic hematuria without shock need not. However, should physical examination or associated injuries prompt reasonable suspicion of a renal injury, renal imaging should be undertaken. This is especially true of patients with rapid deceleration trauma, who may have renal injury without the presence of hematuria

Symptoms

There is usually visible evidence of abdominal trauma. Pain may be localized to one flank area or over the abdomen. Associated injuries such as ruptured abdominal viscera or multiple pelvic fractures also cause acute abdominal pain and may obscure the presence of renal injury. Catheterization usually reveals hematuria. Retroperitoneal bleeding may cause abdominal distention, ileus, and nausea and vomiting.

Signs

Initially, shock or signs of a large loss of blood from heavy retroperitoneal bleeding may be noted. Ecchymosis in the flank or upper quadrants of the abdomen is often noted. Lower rib fractures are frequently found. Diffuse abdominal tenderness may be found on palpation; an "acute abdomen" usually indicates free blood in the peritoneal cavity. A palpable mass may represent a large retroperitoneal hematoma or perhaps urinary extravasation. If the retroperitoneum has been torn, free blood may be noted in the peritoneal cavity but no palpable mass will be evident. The abdomen may be distended and bowel sounds absent.

Laboratory Findings

Microscopic or gross hematuria is usually present. The hematocrit may be normal initially, but a drop may be found when serial studies are done. This finding represents persistent retroperitoneal bleeding and development of a large retroperitoneal hematoma. Persistent bleeding may necessitate operation.

Staging and X-Ray Findings

Staging of renal injuries allows a systematic approach to these problems. Adequate studies help define the extent of injury and dictate appropriate management. For example, blunt trauma to the abdomen associated with gross hematuria and a normal urogram requires no additional renal studies; however, nonvisualization of the kidney requires immediate arteriography or CT scan to determine whether renal vascular injury exists. Ultrasonography and retrograde urography are of little use initially in the evaluation of renal injuries.

Staging begins with an abdominal CT scan, the most direct and effective means of staging renal injuries. This noninvasive technique clearly defines parenchymal lacerations and urinary extravasation, shows the extent of the retroperitoneal hematoma, identifies nonviable tissue, and outlines injuries to surrounding organs such as the pancreas, spleen, liver, and bowel . (If CT is not available, an intravenous pyelogram can be obtained).

Arteriography defines major arterial and parenchymal injuries when previous studies have not fully done so. Arterial thrombosis and avulsion of the renal pedicle are best diagnosed by arteriography and are likely when the kidney is not visualized on imaging studies. The major causes of nonvisualization on an excretory urogram are total pedicle avulsion, arterial thrombosis, severe contusion causing vascular spasm, and absence of the kidney (either congenital or from operation).

Radionuclide renal scans have been used in staging renal trauma. However, in emergency management, this technique is less sensitive than arteriography or CT.

Differential Diagnosis

Trauma to the abdomen and flank areas is not always associated with renal injury. In such cases, there is no hematuria, and the results of imaging studies are normal.

Complications

Early Complications

Hemorrhage is perhaps the most important immediate complication of renal injury. Heavy retroperitoneal bleeding may result in rapid exsanguination. Patients must be observed closely, with careful monitoring of blood pressure and hematocrit. Complete staging must be done early. The size and expansion of palpable masses must be carefully monitored. Bleeding ceases spontaneously in 80 - 85% of cases. Persistent retroperitoneal bleeding or heavy gross hematuria may require early operation.

Urinary extravasation from renal fracture may show as an expanding mass (urinoma) in the retroperitoneum. These collections are prone to abscess formation and sepsis. A resolving retroperitoneal hematoma may cause slight fever (38.3°C), but higher temperatures suggest infection. A perinephric abscess may form, resulting in abdominal tenderness and flank pain.

Late Complications

Hypertension, hydronephrosis, arteriovenous fistula, calculus formation, and pyelonephritis are important late complications. Careful monitoring of blood pressure for several months is necessary to watch for hypertension. At 6 months, a follow-up excretory urogram or CT scan should be obtained to be certain that perinephric

scarring has not caused hydronephrosis or vascular compromise; renal atrophy may occur from vascular compromise and is detected by follow-up urography. Heavy late may occur 4 weeks after injury.

Treatment

Emergency Measures

The objectives of early management are prompt treatment of shock and hemorrhage, complete resuscitation, and evaluation of associated injuries.

Surgical Measures

Blunt Injuries

Minor renal injuries from blunt trauma account for 85% of cases and do not usually require operation. Bleeding stops spontaneously with bed rest and hydration. Cases in which operation is indicated include those associated with persistent retroperitoneal bleeding, urinary extravasation, evidence of nonviable renal parenchyma, and renal pedicle injuries (less than 5% of all renal injuries). Aggressive preoperative staging allows complete definition of injury before operation.

Penetrating Injuries

Penetrating injuries should be surgically explored. A rare exception to this rule is when staging has been complete and only minor parenchymal injury, with no urinary extravasation, is noted. In 80% of cases of penetrating injury, associated organ injury requires operation; thus, renal exploration is only an extension of this procedure.

Treatment of Complications

Retroperitoneal urinoma or perinephric abscess demands prompt surgical drainage. Malignant hypertension requires vascular repair or nephrectomy. Hydronephrosis may require surgical correction or nephrectomy.

Prognosis

With careful follow-up, most renal injuries have an excellent prognosis, with spontaneous healing and return of renal function. Follow-up excretory urography and monitoring of blood pressure ensure detection and appropriate management of late hydronephrosis and hypertension.

Injuries to the Ureter

Ureteral injury is rare but may occur, usually during the course of a difficult pelvic surgical procedure or as a result of gunshot wounds. Rapid deceleration accidents may avulse the ureter from the renal pelvis. Endoscopic basket manipulation of ureteral calculi may result in injury.

Etiology

Large pelvic masses (benign or malignant) may displace the ureter laterally and engulf it in reactive fibrosis. This may lead to ureteral injury during dissection, since the organ is anatomically malpositioned. Inflammatory pelvic disorders may involve the ureter in a similar way. Extensive carcinoma of the colon may invade areas outside the colon wall and directly involve the ureter; thus, resection of the ureter may be required along with resection of the tumor mass. Devascularization may occur with extensive pelvic lymph node dissections or after radiation therapy to the pelvis for pelvic cancer. In these situations, ureteral fibrosis and subsequent stricture formation may develop along with ureteral fistulas.

Endoscopic manipulation of a ureteral calculus with a stone basket or ureteroscope may result in ureteral perforation or avulsion.

Pathogenesis. Pathology

The ureter may be inadvertently ligated and cut during difficult pelvic surgery. In such cases, sepsis and severe renal damage usually occur postoperatively. If a

partially divided ureter is unrecognized at operation, urinary extravasation and subsequent buildup of a large urinoma will ensue, which usually leads to ureterovaginal or ureterocutaneous fistula formation. Intraperitoneal extravasation of urine can also occur, causing ileus and peritonitis. After partial transection of the ureter, some degree of stenosis and reactive fibrosis develops, with concomitant mild to moderate hydronephrosis.

Clinical Findings

Symptoms

If the ureter has been completely or partially ligated during operation, the postoperative course is usually marked by fever of 38.3B°–38.8 B°C (101B°–102 B°F) as well as flank and lower quadrant pain. Such patients often experience paralytic ileus with nausea and vomiting. If ureterovaginal or cutaneous fistula develops, it usually does so within the first 10 postoperative days.

Ureteral injuries from external violence should be suspected in patients who have sustained stab or gunshot wounds to the retroperitoneum. The mid portion of the ureter seems to be the most common site of penetrating injury. There are usually associated vascular and other abdominal visceral injuries.

Signs

The acute hydronephrosis of a totally ligated ureter results in severe flank pain and abdominal pain with nausea and vomiting early in the postoperative course and with associated ileus. Signs and symptoms of acute peritonitis may be present if there is urinary extravasation into the peritoneal cavity. Watery discharge from the wound or vagina may be identified as urine by determining the creatinine concentration of a small sample urine has many times the creatinine concentration found in serumB°”and by intravenous injection of 10 mL of indigo carmine, which will appear in the urine as dark blue.

Laboratory Findings

Ureteral injury from external violence is manifested by microscopic hematuria in 90% of cases. Urinalysis and other laboratory studies are of little use in diagnosis when injury has occurred from other causes.

Imaging Findings

Diagnosis is by excretory urography. A plain film of the abdomen may demonstrate a large area of increased density in the pelvis or in an area of retroperitoneum where injury is suspected. After injection of contrast material, delayed excretion is noted with hydronephrosis. Partial transection of the ureter results in more rapid excretion, but persistent hydronephrosis is usually present, and contrast extravasation at the site of injury is noted on delayed films.

In acute injury from external violence, the excretory urogram usually appears normal, with very mild fullness down to the point of extravasation at the ureteral transection.

Retrograde ureterography demonstrates the exact site of obstruction or extravasation.

Ultrasonography

Ultrasonography outlines hydroureter or urinary extravasation as it develops into a urinoma and is perhaps the best means of ruling out ureteral injury in the early postoperative period.

Radionuclide Scanning

Radionuclide scanning demonstrates delayed excretion on the injured side, with evidence of increasing counts owing to accumulation of urine in the renal pelvis. Its great benefit, however, is in the assessment of renal function after surgical correction.

Differential Diagnosis

Postoperative bowel obstruction and peritonitis may cause symptoms similar to those of acute ureteral obstruction from injury. Fever, "acute abdomen," and associated nausea and vomiting following difficult pelvic surgery are definite indications for screening sonography or excretory urography to establish whether ureteral injury has occurred.

Deep wound infection must be considered postoperatively in patients with fever, ileus, and localized tenderness. The same findings are consistent with urinary extravasation and urinoma formation.

Acute pyelonephritis in the early postoperative period may also result in findings similar to those of ureteral injury. Sonography shows normal results, and urography shows no evidence of obstruction.

Complications

Ureteral injury may be complicated by stricture formation with resulting hydronephrosis in the area of injury. Chronic urinary extravasation from unrecognized injury may lead to formation of a large retroperitoneal urinoma. Pyelonephritis from hydronephrosis and urinary infection may require prompt proximal drainage.

Treatment

Prompt treatment of ureteral injuries is required. The best opportunity for successful repair is in the operating room when the injury occurs. If the injury is not recognized until 7 - 10 days after the event and no infection, abscess, or other complications exist, immediate reexploration and repair are indicated. Proximal urinary drainage by percutaneous nephrostomy or formal nephrostomy should be considered if the injury is recognized late or if the patient has significant complications that make immediate reconstruction unsatisfactory. The goals of

ureteral repair are to achieve complete debridement, a tension-free spatulated anastomosis, watertight closure, ureteral stenting (in selected cases), and retroperitoneal drainage.

Lower Ureteral Injuries

Injuries to the lower third of the ureter allow several options in management. The procedure of choice is reimplantation into the bladder combined with a psoas-hitch procedure to minimize tension on the ureteral anastomosis. An antireflux procedure should be done when possible. Primary ureteroureterostomy can be used in lower-third injuries when the ureter has been ligated without transection. The ureter is usually long enough for this type of anastomosis. A bladder tube flap can be used when the ureter is shorter.

Transureteroureterostomy may be used in lower-third injuries if extensive urinoma and pelvic infection have developed. This procedure allows anastomosis and reconstruction in an area away from the pathologic processes.

Midureteral Injuries

Midureteral injuries usually result from external violence and are best repaired by primary ureteroureterostomy or transureteroureterostomy.

Upper Ureteral Injuries

Injuries to the upper third of the ureter are best managed by primary ureteroureterostomy. If there is extensive loss of the ureter, autotransplantation of the kidney can be done as well as bowel replacement of the ureter.

Stenting

Most anastomoses after repair of ureteral injury should be stented. The preferred technique is to insert a silicone internal stent through the anastomosis before closure. These stents have a J memory curve on each end to prevent their migration in the

postoperative period. After 3 - 4 weeks of healing, stents can be endoscopically removed from the bladder. The advantages of internal stenting are maintenance of a straight ureter with a constant caliber during early healing, the presence of a conduit for urine during healing, prevention of urinary extravasation, maintenance of urinary diversion, and easy removal.

Prognosis

The prognosis for ureteral injury is excellent if the diagnosis is made early and prompt corrective surgery is done. Delay in diagnosis worsens the prognosis because of infection, hydronephrosis, abscess, and fistula formation.

Injuries to the Bladder

Bladder injuries occur most often from external force and are often associated with pelvic fractures. (About 15% of all pelvic fractures are associated with concomitant bladder or urethral injuries.) Iatrogenic injury may result from gynecologic and other extensive pelvic procedures as well as from hernia repairs and transurethral operations.

Pathogenesis & Pathology

The bony pelvis protects the urinary bladder very well. When the pelvis is fractured by blunt trauma, fragments from the fracture site may perforate the bladder. These perforations usually result in extraperitoneal rupture. If the urine is infected, extraperitoneal bladder perforations may result in deep pelvic abscess and severe pelvic inflammation.

When the bladder is filled to near capacity, a direct blow to the lower abdomen may result in bladder disruption. This type of disruption ordinarily is intraperitoneal. Since the reflection of the pelvic peritoneum covers the dome of the bladder, a linear laceration will allow urine to flow into the abdominal cavity. If the diagnosis is not

established immediately and if the urine is sterile, no symptoms may be noted for several days. If the urine is infected, immediate peritonitis and acute abdomen will develop.

Clinical Findings

Pelvic fracture accompanies bladder rupture in 90% of cases. The diagnosis of pelvic fracture can be made initially in the emergency room by lateral compression on the bony pelvis, since the fracture site will show crepitus and be painful to the touch.

Symptoms

There is usually a history of lower abdominal trauma. Blunt injury is the usual cause. Patients ordinarily are unable to urinate, but when spontaneous voiding occurs, gross hematuria is usually present. Most patients complain of pelvic or lower abdominal pain.

Signs

Heavy bleeding associated with pelvic fracture may result in hemorrhagic shock, usually from venous disruption of pelvic vessels. Evidence of external injury from a gunshot or stab wound in the lower abdomen should make one suspect bladder injury, manifested by marked tenderness of the suprapubic area and lower abdomen. An acute abdomen may occur with intraperitoneal bladder rupture. On rectal examination, landmarks may be indistinct because of a large pelvic hematoma.

Laboratory Findings

Catheterization usually is required in patients with pelvic trauma but not if bloody urethral discharge is noted. Bloody urethral discharge indicates urethral injury, and a urethrogram is necessary before catheterization. When catheterization is done, gross or, less commonly, microscopic hematuria is usually present. Urine taken from

the bladder at the initial catheterization should be cultured to determine whether infection is present.

X-Ray Findings

A plain abdominal film generally demonstrates pelvic fractures. There may be haziness over the lower abdomen from blood and urine extravasation. A CT scan should be obtained to establish whether kidney and ureteral injuries are present.

Bladder disruption is shown on cystography. The bladder should be filled with 300 mL of contrast material and a plain film of the lower abdomen obtained. Contrast medium should be allowed to drain out completely, and a second film of the abdomen should be obtained. The drainage film is extremely important, because it demonstrates areas of extraperitoneal extravasation of blood and urine that may not appear on the filling film. With intraperitoneal extravasation, free contrast medium is visualized in the abdomen, highlighting bowel loops.

CT cystography is an excellent method for detecting bladder rupture; however, retrograde filling of the bladder with 300 mL of contrast medium is necessary to distend the bladder completely. Incomplete distention with consequent missed diagnosis of bladder rupture often occurs when the urethral catheter is clamped during standard abdominal CT scan with intravenous contrast injection.

Injuries to the Urethra

Urethral injuries are uncommon and occur most often in men, usually associated with pelvic fractures or straddle-type falls. They are rare in women.

Various parts of the urethra may be lacerated, transected, or contused. Management varies according to the level of injury. The urethra can be separated into 2 broad anatomic divisions: the posterior urethra, consisting of the prostatic and

membranous portions, and the anterior urethra, consisting of the bulbous and pendulous portions.

Injuries to the Posterior Urethra

Etiology

The membranous urethra passes through the pelvic floor and voluntary urinary sphincter and is the portion of the posterior urethra most likely to be injured. When pelvic fractures occur from blunt trauma, the membranous urethra is sheared from the prostatic apex at the prostatomembranous junction. The urethra can be transected by the same mechanism at the interior surface of the membranous urethra.

Clinical Findings

Symptoms

Patients usually complain of lower abdominal pain and inability to urinate. A history of crushing injury to the pelvis is usually obtained.

Signs

Blood at the urethral meatus is the single most important sign of urethral injury. The importance of this finding cannot be overemphasized, because an attempt to pass a urethral catheter may result in infection of the periprostatic and perivesical hematoma and conversion of an incomplete laceration to a complete one. The presence of blood at the external urethral meatus indicates that immediate urethrography is necessary to establish the diagnosis.

Suprapubic tenderness and the presence of pelvic fracture are noted on physical examination. A large developing pelvic hematoma may be palpated. Perineal or suprapubic contusions are often noted. Rectal examination may reveal a large pelvic hematoma with the prostate displaced superiorly. Rectal examination can be misleading, however, because a tense pelvic hematoma may resemble the prostate on

palpation. Superior displacement of the prostate does not occur if the puboprostatic ligaments remain intact. Partial disruption of the membranous urethra (currently 10% of cases) is not accompanied by prostatic displacement.

X-Ray Findings

Fractures of the bony pelvis are usually present. A urethrogram (using 20 -30 mL of water-soluble contrast material) shows the site of extravasation at the prostatomembranous junction. Ordinarily, there is free extravasation of contrast material into the perivesical space. Incomplete prostatomembranous disruption is seen as minor extravasation, with a portion of contrast material passing into the prostatic urethra and bladder.

Instrumental Examination

The only instrumentation involved should be for urethrography. Catheterization or urethroscopy should not be done, because these procedures pose an increased risk of hematoma, infection, and further damage to partial urethral disruptions.

Differential Diagnosis

Bladder rupture may be associated with posterior urethral injuries in approximately 20% of cases. Cystography cannot be done preoperatively, since a urethral catheter should not be passed. Careful evaluation of the bladder at operation is necessary.

Complications

Stricture, impotence, and incontinence as complications of prostatomembranous disruption are among the most severe and debilitating mishaps that result from trauma to the urinary system. Stricture following primary repair and anastomosis occurs in about 50% of cases. If the preferred suprapubic cystostomy approach with delayed repair is used, the incidence of stricture can be reduced to about 5%.

The incidence of impotence after primary repair is 30 - 80% (mean, about 50%). This figure can be reduced to 30 - 35% by suprapubic drainage with delayed urethral reconstruction.

Incontinence in primary reanastomosis is noted in one-third of patients. Delayed reconstruction reduces the incidence to less than 5%.

Treatment

Emergency Measures

Shock and hemorrhage should be treated.

Surgical Measures

Urethral catheterization should be avoided.

Immediate Management

Initial management should consist of suprapubic cystostomy to provide urinary drainage. A midline lower abdominal incision should be made, with care being taken to avoid the large pelvic hematoma. The bladder and prostate are usually elevated superiorly by large periprostatic and perivesical hematomas. The bladder often is distended by a large volume of urine accumulated during the period of resuscitation and operative preparation. The urine is often clear and free of blood, but gross hematuria may be present. The bladder should be opened in the midline and carefully inspected for lacerations. If a laceration is present, the bladder should be closed with absorbable suture material and a cystostomy tube inserted for urinary drainage. This approach involves no urethral instrumentation or manipulation. The suprapubic cystostomy is maintained in place for about 3 months. This allows resolution of the pelvic hematoma, and the prostate and bladder will slowly return to their anatomic positions.

Incomplete laceration of the posterior urethra heals spontaneously, and the suprapubic cystostomy can be removed within 2 -3 weeks. The cystostomy tube should not be removed before voiding cystourethrography shows that no extravasation persists.

Delayed Urethral Reconstruction

Reconstruction of the urethra after prostatic disruption can be undertaken within 3 months, assuming there is no pelvic abscess or other evidence of persistent pelvic infection. Before reconstruction, a combined cystogram and urethrogram should be done to determine the exact length of the resulting urethral stricture. This stricture usually is 1 - 2 cm long and situated immediately posterior to the pubic bone. The preferred approach is a single-stage reconstruction of the urethral rupture defect with direct excision of the strictured area and anastomosis of the bulbous urethra directly to the apex of the prostate. A 16F silicone urethral catheter should be left in place along with a suprapubic cystostomy. Catheters are removed within a month, and the patient is then able to void.

Immediate Urethral Realignment

Some surgeons prefer to realign the urethra immediately. Persistent bleeding and surrounding hematoma create technical problems. The incidence of stricture, impotence, and incontinence appears to be higher than with immediate cystostomy and delayed reconstruction. However, several authors have reported success with immediate urethral realignment.

General Measures

After delayed reconstruction by a perineal approach, patients are allowed ambulation on the first postoperative day and usually can be discharged within 3 days.

Treatment of Complications

Treatment of Complications

Approximately 1 month after the delayed reconstruction, the urethral catheter can be removed and a voiding cystogram obtained through the suprapubic cystostomy tube. If the cystogram shows a patent area of reconstruction free of extravasation, the suprapubic catheter can be removed; if there is extravasation or stricture, suprapubic cystostomy should be maintained. A follow-up urethrogram should be obtained within 2 months to watch for stricture development.

Stricture, if present (< 5%), is usually very short, and urethrotomy under direct vision offers easy and rapid cure.

The patient may be impotent for several months after delayed repair. Impotence is permanent in about 10% of patients. Implantation of a penile prosthesis is indicated if impotence is still present 2 years after reconstruction (see Chapter 37: Male Sexual Dysfunction).

Incontinence after posterior urethral rupture and delayed repair is rare (< 2%) and is usually related to the extent of injury rather than to the repair.

Prognosis

If complications can be avoided, the prognosis is excellent. Urinary infections ultimately resolve with appropriate management

Injuries to the Anterior Urethra

Etiology

The anterior urethra is the portion distal to the urogenital diaphragm. Straddle injury may cause laceration or contusion of the urethra. Self-instrumentation or iatrogenic instrumentation may cause partial disruption.

Pathogenesis & Pathology

Contusion

Contusion of the urethra is a sign of crush injury without urethral disruption. Perineal hematoma usually resolves without complications.

Laceration

A severe straddle injury may result in laceration of part of the urethral wall, allowing extravasation of urine. If the extravasation is unrecognized, it may extend into the scrotum, along the penile shaft, and up to the abdominal wall. It is limited only by Colles' fascia and often results in sepsis, infection, and serious morbidity.

Clinical Findings

Symptoms

There is usually a history of a fall, and in some cases a history of instrumentation. Bleeding from the urethra is usually present. There is local pain into the perineum and sometimes massive perineal hematoma. If voiding has occurred and extravasation is noted, sudden swelling in the area will be present. If diagnosis has been delayed, sepsis and severe infection may be present.

Signs

The perineum is very tender, and a mass may be found. Rectal examination reveals a normal prostate. The patient usually has a desire to void, but voiding should not be allowed until assessment of the urethra is complete. No attempt should be made to pass a urethral catheter, but if the patient's bladder is overdistended, percutaneous suprapubic cystostomy can be done as a temporary procedure.

When presentation of such injuries is delayed, there is massive urinary extravasation and infection in the perineum and the scrotum. The lower abdominal wall may also be involved. The skin is usually swollen and discolored.

Laboratory Findings

Blood loss is not usually excessive, particularly if secondary injury has occurred. The white count may be elevated with infection.

X-Ray Findings

A urethrogram, with instillation of 15 - 20 mL of water-soluble contrast material, demonstrates extravasation and the location of injury. A contused urethra shows no evidence of extravasation.

Complications

Heavy bleeding from the corpus spongiosum injury may occur in the perineum as well as through the urethral meatus. Pressure applied to the perineum over the site of the injury usually controls bleeding. If hemorrhage cannot be controlled, immediate operation is required.

The complications of urinary extravasation are chiefly sepsis and infection. Aggressive debridement and drainage are required if there is infection.

Stricture at the site of injury is a common complication, but surgical reconstruction may not be required unless the stricture significantly reduces urinary flow rates.

Treatment

General Measures

Major blood loss usually does not occur from straddle injury. If heavy bleeding does occur, local pressure for control, followed by resuscitation, is required.

Specific Measures

Urethral Contusion

The patient with urethral contusion shows no evidence of extravasation, and the urethra remains intact. After urethrography, the patient is allowed to void; and if the voiding occurs normally, without pain or bleeding, no additional treatment is necessary. If bleeding persists, urethral catheter drainage can be done.

Urethral Lacerations

Instrumentation of the urethra following urethrography should be avoided. A small midline incision in the suprapubic area readily exposes the dome of the bladder so that a suprapubic cystostomy tube can be inserted, allowing complete urinary diversion while the urethral laceration heals. Percutaneous cystostomy may also be used in such injuries. If only minor extravasation is noted on the urethrogram, a voiding study can be performed within 7 days after suprapubic catheter drainage to search for extravasation. In more extensive injuries, one should wait 2 -3 weeks before doing a voiding study through the suprapubic catheter. Healing at the site of injury may result in stricture formation. Most of these strictures are not severe and do not require surgical reconstruction. The suprapubic cystostomy catheter may be removed if no extravasation is documented. Follow-up with documentation of urinary flow rates will show whether there is urethral obstruction from stricture.

Urethral Laceration with Extensive Urinary Extravasation

After major laceration, urinary extravasation may involve the perineum, scrotum, and lower abdomen. Drainage of these areas is indicated. Suprapubic cystostomy for urinary diversion is required. Infection and abscess formation are common and require antibiotic therapy.

Immediate Repair

Immediate repair of urethral lacerations can be performed, but the procedure is difficult and the incidence of associated stricture is high.

Treatment of Complications

Strictures at the site of injury may be extensive and require delayed reconstruction.

Prognosis

Urethral stricture is a major complication but in most cases does not require surgical reconstruction. If, when stricture resolves, urinary flow rates are poor and urinary infection and urethral fistula are present, reconstruction is required.

Injuries to the Penis

Disruption of the tunica albuginea of the penis (penile fracture) can occur during sexual intercourse. At presentation, the patient has penile pain and hematoma. This injury should be surgically corrected.

Gangrene and urethral injury may be caused by obstructing rings placed around the base of the penis. These objects must be removed without causing further damage. Penile amputation is seen occasionally, and in a few patients, the penis can be surgically replaced successfully by microsurgical techniques.

Total avulsion of the penile skin occurs from machinery injuries. Immediate debridement and skin grafting are usually successful in salvage.

Injuries to the penis should suggest possible urethral damage, which should be investigated by urethrography/

Injuries to the Scrotum

Superficial lacerations of the scrotum may be debrided and closed primarily. Blunt trauma may cause local hematoma and ecchymosis, but these injuries resolve without difficulty. One must be certain that testicular rupture has not occurred.

Total avulsion of the scrotal skin may be caused by machinery accidents or other major trauma. The testes and spermatic cords are usually intact. It is important to provide coverage for these structures: this is best done by immediate surgical debridement and by placing the testes and spermatic cords in the subcutaneous tissues of the upper thighs. Later reconstruction of the scrotum can be done with a skin graft or thigh flap.

TEST TASKS

Damage to the organs of the genitourinary system

1. Kidney injuries are characterized by:
 - A - difficulty breathing
 - B - symptoms of irritation of the peritoneum
 - C - pain in the lumbar region
2. The main method of diagnosing urethral tears is:
 - A - intravenous urography
 - B - cystography
 - C – urethrography
3. A reliable sign of open kidney damage is:
 - A - hematuria
 - B - wound localization
 - C - urohematoma
 - D - urine leakage from the wound

4. Iatrogenic ureteral injuries are more common in:

A - surgical operations

B - urological operations

D - gynecological operations

5. For the diagnosis of kidney injury is shown:

A - v/v urography

B - radioisotope renography

C - kidney scanning

6. Intra-abdominal bladder rupture is characterized by:

A - terminal hematuria

B - impossibility of independent voiding

C - the presence of signs of urinary leakage

7. When performing retrograde cystography in case of suspected bladder rupture it is necessary:

A - injection of up to 50 ml of contrast agent

B - injection of up to 150 ml of contrast agent

C - tight filling of the bladder

8. In case of suspected bladder rupture it is indicated:

- A - outpatient observation
- B - outpatient treatment in an outpatient clinic
- C - planned hospitalization in a hospital
- D - immediate hospitalization in a hospital

9. Symptom of urethral rupture:

- A - total macrohematuria
- B - urethrorrhagia
- C - the presence of blood clots in the urine

10. At extraperitoneal bladder rupture it is shown:

- A - to install a permanent urethral catheter
- B - prescription of antibiotics and hemostatic agents
- C - surgical treatment

11. The patient has initial (initial) hematuria. Preliminary diagnosis:

- A - nephrolithiasis
- B - tuberculosis of the kidney
- C - neoplasm of the bladder
- D - tumors of the spermatic cord

E - trauma of the fixed part of the urethra.

12. A sign of kidney injury is:

A - pain when urinating

B - hematuria

C – pneumaturia

13. A sign of kidney injury is:

A - initial hematuria

B - terminal hematuria

C - total hematuria

CORRECT ANSWERS

1		6		11	
2		7		12	
3		8		13	
4		9			
5		10			

SECTION II

EMERGENCY CARE IN UROLOGICAL DISEASES

The issues of emergency urology should be well known to a doctor of any specialty, since the first aid to this category of patients is provided by the doctor to whom the patient urgently applied. The doctor must timely diagnose the disease, clearly know the treatment tactics.

Aims: to acquaint students with the symptomatology, clinical course, diagnosis, differential diagnosis and treatment of renal colic, anuria, hematuria, acute urinary retention, to teach students to provide timely and correct first aid, to pay attention to the examination of working capacity.

Didactic objectives:

1. To study the causes and mechanism of emergency conditions in urological diseases.
2. To know the classification of anuria, hematuria, urinary retention, types of acute purulent pyelonephritis.
3. To study in detail the symptoms of renal colic, anuria, hematuria, acute urinary retention.
4. To master the methods of diagnosis of these syndromes.
5. To learn to conduct differential diagnostics of renal colic and acute surgical diseases of the abdominal organs. To emphasize the importance of chromocystology in the differential diagnosis.
6. To teach students to provide first aid in renal colic, anuria, hematuria, acute urinary retention.

2.1. Renal colic.

Renal colic is a symptom complex, which is one of the individual manifestations of many diseases of the kidneys and upper respiratory tract.

Causes of renal colic:

1. Acute mechanical obstruction of the normal passage of urine from the renal pelvis (concretions, blood clots, salts, pus, mucus, narrowing of the ureter, kinks, nephroptosis).
2. General, allergic kidney diseases: pyelonephritis, kidney tuberculosis.
3. Acute vascular diseases of the kidneys (thromboembolism of the renal artery or vein, kidney infarction).
4. Urodynamic disorder of the upper ureter.

Most often (in 50 cases) renal colic occurs in urolithiasis. Often it complicates the clinical course of hydronephrosis, tuberculosis, nonspecific purulent general diseases, kidney and ureteral tumors, nephroptosis.

Pathogenesis of renal colic and symptoms caused by it.

In the development of renal colic, the main points are local spasm of the upper ureter, internal renal pelvic hypertension, pelvic-renal refluxes, renal hemodynamics and urodynamics disorders resulting from complete obturation of the ureters.

The consequence of these factors is the main symptom of colic - extremely intense, sudden pain in the lumbar region. Irradiation of pain throughout the abdomen, groin, thigh, external genitals is characteristic, due to the peculiarities of inertia. Other symptoms are caused by the main and are mostly reflexive in nature: dysuric phenomena, gastrointestinal symptoms (nausea, vomiting, flatulence, stool retention, gas).

The above features of pathogenesis and symptoms should be taken into account when taking anamnesis.

During the objective examination, attention should be paid to the patient's restless behavior. During the examination, abdominal distention (flatulence) can be detected. By percussion, the symptoms of Pasternatsky, Fronshtein are detected. Palpation reveals tenderness in the Gorash point, in the ureteric points, in the projection of the kidney.

In the general blood test, 40-50% of patients have leukocytosis, often with a shift of the leukocyte formula to the left, in the urine analysis - hematuria, pyuria, mild proteinuria, salt crystal.

The diagnostic value of special methods of examination is noted - chromocystoscopy, inspection and excretory urography, radioisotope renography.

Differential diagnostics with acute surgical diseases of the abdominal cavity, ectopic pregnancy is carried out.

A reasonable diagnosis is formulated with an indication of the underlying disease complicated by renal colic. Then the treatment measures are considered. In order to eliminate the spasm of the upper ureter, thermal procedures, antispasmodics (no-shpa, baralgin, platyphylline, atropine), analgesics (analgin, promedol, dimedrol) are used. If these drugs have no effect, novocaine blockade by Lorin-Enstein, Shkolnikov is used. In the absence of effect, resort to ureteral catheterization and surgical treatment (pyelolithotomy, ureterolithotomy).

2.2. Hematuria.

Classification of hematuria:

- microscopic,
- macroscopic,

- initial,
- terminal,
- total.

Clinical analysis of a patient with total profuse hematuria requiring emergency care is carried out. Causes of hematuria that can cause kidney disease (tumors, tuberculosis, trauma, cystic degeneration, stones), ureters (tumors, stones), bladder (tumors, varicose veins of the bladder, inflammation, stones), prostate (adenoma, cancer), urethra (tumors, angiomas, trauma) are preliminarily considered.

Profuse hematuria is usually caused by tumors of the kidneys, ureter, prostate, tuberculosis and kidney trauma.

Anamnesis is found out:

- the appearance of hematuria in the past;
- the presence of symptoms characteristic of kidney disease: pain in the lower back, bladder, prostate, various urinary disorders;
- when hematuria appeared, what symptoms accompanied it.

It should be emphasized that the so-called asymptomatic hematuria is typical for kidney and bladder tumors.

The nature of blood clots:

- worm-like clots are found when bleeding from the kidney,
- ureter (cast of the ureter).

An objective examination of the patient is of great importance in the diagnosis, as it can indicate the source of bleeding. A detailed palpation of the kidneys is carried out in the position of the patient on the back, opposite side, standing. The

symptoms of Pasternacki, Fronstein, Gorash are checked. In the presence of a kidney tumor, the latter is often palpated in the form of a dense, tuberous induration. In the presence of a tumor, Roberts' symptoms (tympanitis when percussing over the tumor) and balloting are determined.

In case of bladder tamponade with blood clots, its enlargement is determined by percussion (dullness over the symphysis) and palpation (spherical formation). In men, a rectal finger examination of the prostate should be carried out, which allows to diagnose a prostate tumor.

Doctor's tactics for diffuse hematuria. The above-mentioned examination of the patient is carried out. It is necessary to study the state of cardiovascular activity, the number of red blood cells and hemoglobin and observe them in dynamics. Immediately carry out conservative treatment in the form of blood transfusion, plasma, administration of calcium chloride, vicasol, aminocaproic acid, fibrinogen, cardiac drugs, bladder flushing with a tow truck. If the above measures do not give results within the next few hours, anemia deepens, blood pressure drops, and the anamnesis and physical examination data are not enough to determine the source of bleeding, then a special urological examination of the patient is urgently carried out. This examination in urgent cases is limited to methods that make it possible to make an accurate diagnosis of the source of hematuria and decide on the place of surgical intervention (on the kidney or bladder) and the possibility of removing the affected kidney. To do this, it is enough to conduct chromocystoscopy, plain radiography, excretory urography.

If the source of hematuria is the kidney, then lumbotomy and revision of the kidney are performed. The scope of the operation is determined after examination of the kidney (nephrectomy, resection). If the source of bleeding is in the bladder, a cystotomy is performed and the bladder is examined empty.

Either removal of the bladder tumor, or electrocoagulation of the bleeding areas, or stitching them, or tamponade is performed. Often, cystotomy surgery is sufficient to stop bleeding from the bladder.

2.3 Anuria

During the clinical examination of a patient with anuria, first of all, the concept of this syndrome is defined. Anuria is characterized by the absence of urine discharge from the upper ureter into the bladder. Anuria is always a formidable syndrome that signals a catastrophe that directly threatens the patient's life.

Causes of anuria:

1. Arenal - in the absence of both kidneys (congenital).
2. Prerenal - a disorder of blood flow to the kidneys (compression, thrombosis of the renal vessels).
3. Renal - lack of urine excretion by specific elements of the renal parenchyma due to their damage (nephritis, nephrosis, pyelonephritis, toxic damage).
4. Subrenal - obturation of the ureters (usually concretory).
5. Extrarenal - a sharp disorder of blood circulation and a drop in blood pressure.
6. Reflex - spasms of renal vessels due to peripheral irritation, often in the urinary system.

There are 3 stages in the clinical course of anuria:

- tolerance,
- intoxication,
- uremia.

In the tolerance stage, the main complaint of patients is the lack of urination and urge to urinate. During this period, other organs (gastrointestinal tract, skin, mucous membranes) take over the function of excretion of nitrogenous toxins from the body. There are no signs of intoxication. The stage lasts 4-7 days. When all the compensators of the excretory properties of the body are exhausted, nitrogenous substances, potassium begin to accumulate in the tissues, and acidosis occurs. The second period of intoxication begins. The patient complains of weakness, loss of appetite, nausea, vomiting, headache. Biochemical blood tests reveal hyperazotemia (residual nitrogen 100 mg% and above), hyperkalemia, acidosis. During the objective examination of the patient: adynamia, pallor of the skin with an earthy tint, subacidity, dry tongue, oral mucosa, signs of cardiac decline (toxic myocardium), signs of uremic pneumonia, colitis. In case of further intoxication - death from uremia (III stage) in comatose state of the patient.

For the diagnosis and determination of the type of anuria, the analysis data help. For example, renal anuria is characterized by a history of prolonged chronic kidney disease, poisoning with sulema and other poisons, taking large amounts of sulfonamides; for subrenal anuria - its occurrence after an attack of low back pain; for extrarenal anuria - trauma, acute cardiovascular failure, shock, collapse; for reflex anuria - trauma to the urinary system with instruments, operations on the urinary system and abdominal cavity.

During the objective examination of the patient, attention is paid to the condition of the skin, mucous membranes, tongue, pulse, blood pressure. In renal, subrenal forms of anuria, the symptoms of Pasternacki, Fronsztejt, Gorash are often positive. In anuria, unlike acute urinary retention, there is no blunting of the percussion sound in the suprapubic area, and the bladder is not detected on palpation. Anuria is characterized by the absence of urine in the bladder. This is determined by bladder catheterization. Attention is also drawn to the data of biochemical blood tests

(residual nitrogen, urea, creatinine, potassium, sodium, chloride, calcium, protein and its fractions).

The final diagnosis is formulated, indicating the type of anuria and its stages. A treatment plan is proposed.

Treatment is carried out depending on the type of anuria. In the arenal form - only kidney transplantation. In case of parenchymal - surgically (release of renal vessels from compression, blood clots), in case of renal depending on the causes. In case of nephritis, pyelonephritis - artificial kidney, in case of sulema poisoning - decapsulation operation, nephrostomy, in case of sulfonamide - washing of the renal pelvis and ureter, nephro- or pyelostomy. In case of subrenal - catheterization of the ureter, surgery to remove the stone, in case of extrarenal - drugs that improve heart function, increase blood pressure, anti-shock measures, in case of reflex paranefral - novocaine blockade, diathermy.

In addition, for all types of anuria, treatment is carried out aimed at detoxification, reducing acidosis. Intravenous administration of glucose, vitamins, sodium bicarbonate is prescribed. About 1 liter of fluids is administered. Intramuscular administration of anabolics (retabolol, testosterone). Gastric lavage, siphon enemas with soda solution. Extracorporeal hemodialysis is performed (indications, contraindications).

2.4. Acute urinary retention.

During the clinical analysis of a patient with acute urinary retention, students must first demonstrate knowledge of the types of urinary retention, learn the concept of acute urinary retention, the causes that cause it.

There's a difference:

- complete and incomplete,

- acute and chronic types of urinary retention.

Emergency care is necessary in case of complete acute urinary retention. This is a condition when urination suddenly stops completely in the presence of strong ineffective urge. The cause of acute complete urinary retention can be prostate tumors (adenoma, cancer), sclerosis of the bladder neck and urethra, bladder stones, urethra, diseases and damage to the central nervous system. The cause of urinary retention can be determined by a detailed medical history and the results of an objective examination of the patient.

The patient's complaints are noted (inability to urinate in the presence of salt urge). The patient's age is indicated (prostate tumors occur in old age). From the anamnesis, it is found out whether the patient had inflammation or injury of the urethra (possibility of stricture), urinary disorders and their nature (difficulty and more often than usual, at night is more typical for prostate tumors), diseases or damage to the nervous system.

An objective examination of the patient is carried out. Acute complete urinary retention is characterized by whitening of the bladder due to overflow of urine. This is determined by percussion (dullness) and an elastic, spherical formation on palpation. Other diagnostic types are used during and after bladder emptying. During bladder catheterization, urethral patency is determined. After emptying the bladder, a rectal finger examination of the prostate is performed (diagnosis of prostate tumors), a plain radiography of the urinary system (detection of stones, condition of the spine), pneumocystography (diagnosis of prostate tumors, stones).

Acute urinary retention requires urgent medical treatment, which consists in emptying the bladder and preventing urinary infection. Bladder emptying, depending on the nature of the disease and the patient's condition, is carried out by three methods:

1. Catheterization of the bladder.
2. Supervisory puncture.
3. Cystostomy operation.

In all cases, the first measure should be bladder catheterization, except for urethral trauma. If catheterization fails for some reason or is contraindicated, a bladder puncture is performed: a thin needle is inserted perpendicular to the anterior abdominal wall along the midline 2-3 cm above the pubic articulation. Urine is removed with a syringe.

If catheterization or bladder puncture is ineffective and urine retention continues, surgery, cystotomy, is performed to prevent infection in the ureter and the development of severe complications.

Test tasks

Emergency care in urological diseases.

1. A 45-year-old woman was admitted to the clinic with complaints of acute left lumbar pain. The pain appeared two days ago, during which time she excreted 300 ml of urine. The right kidney was removed due to calculous pyonephrosis. Ultrasonography showed dilatation of the pelvic-cup system of the only kidney. What should be the initial action in relation to the patient?

- A. Percutaneous (percutaneous) nephrostomy.
- B. Excretory urography.
- C. Chromocystoscopy.
- D. Symptomatic treatment with antispasmodics and analgesics.
- E. Retrograde ureteropyelography.

2. A 50-year-old patient underwent Wertheim's operation for malignant lesion after which acute renal failure (ARF) occurred. Ultrasonography revealed dilatation of the pelvic system of both kidneys. What form of ARF can be assumed in this case?

- A. Prerenal.
- B. Renal.
- C. Arenal.
- D. Reflex.
- E. Postrenal.

3. A 46-year-old patient with benign prostatic hyperplasia developed acute urinary retention. For the differential diagnosis between anuria and acute urinary retention, the patient should perform:

- A. Ultrasound examination of the kidneys.
- B. Bladder catheterization.
- C. Excretory urography.
- D. Cystoscopy.
- E. Cystography.

4. A 35-year-old patient was hospitalized with complaints of acute pain in the lumbar region on the right. The pain irradiated to the right testicle. There was nausea, vomiting, frequent urge to urinate. In urine analysis - hematuria. What is the most likely diagnosis?

- A. Acute appendicitis.
- B. Acute orchioepididymitis.
- C. Renal colic on the right.

D. Hypernefroma of the right kidney.

E. Acute pyelonephritis.

5. A 24-year-old patient complains of pain and swelling of the penis. The patient reported that he was unable to pull back the narrowed anterior glans behind the glans penis. Objectively: there is swelling of the glans penis, hyperemia. Your diagnosis.

A. Paraphimosis.

B. Phimosiis.

C. Penile contusion.

D. Acute balanoposthitis.

E. Acute cavernitis.

6. A 24-year-old patient complains of pain and swelling of the penis. The patient reported that when pulling the narrowed front skin behind the glans penis backwards, he could not straighten it. Objectively: there is swelling of the glans penis, hyperemia. What urgent measures are needed?

A. To insert the glans penis, in case of ineffectiveness to dissect the ring of the front skin.

B. Administer painkillers and antispasmodics.

C. Apply cold and apply a compression bandage.

D. Prescribe antibiotics and antiseptics.

E. Prescribe antibiotics and uroantiseptics.

7. A 75-year-old patient complains of inability to urinate for 12 hours. Abdominal palpation reveals an enlarged bladder. Attempts to catheterize the bladder with rubber and metal catheters are unsuccessful. What should be the doctor's tactics?

- A. Administer antispasmodics and painkillers to the patient.
- B. Conduct a capillary suprapubic puncture of the bladder.
- C. Conduct electrical stimulation of the bladder.
- D. Place the patient in a hot bath.
- E. Administer antispasmodics and re-catheterize the bladder with a rubber catheter.

bladder with a rubber catheter.

8. A 16-year-old boy complains of pain in the right hypochondrium with irradiation to the scrotum, an increase in its size. Temperature is 37.80. Three days ago, while playing football, the boy was hit in the groin by a ball. Objectively: pale skin. On examination of the scrotum, there is slight hyperemia of the skin. Palpation of the appendage shows its thickening and tenderness. What disease does the patient have?

- A. Acute orchitis.
- B. Appendage cyst.
- C. Acute post-traumatic epididymo-orchitis on the right.
- D. Testicular torsion.
- E. Acute hydrocele.

9. A 35-year-old patient was hit by a car. After the injury there is macrohematuria with blood clots. Hemodynamics is stable. What urgent research is necessary to establish the diagnosis?

- A. Biochemical blood test to determine urea and creatinine.
- B. Coagulogram.
- C. Urine analysis by Nechiporenko.
- D. Excretory urography.
- Д. Radioisotope renography.

10. A 46-year-old man has difficulty urinating, pain in the perineum, fever up to 40 ° C. External genital organs are unchanged. Rectally - prostate gland is enlarged, tense, painful. Ultrasound - in the prostate an echo-negative mass up to 1.5 cm with an outer capsule, uneven inner surface and heterogeneous content. In the blood test: WBC - 18×10^9 v / l; ESR - 48 mm / g. In urine: protein - 0.66 g/l; leukocytes - 10-15 in the field of view. What is your diagnosis?

- A. BPH complicated by adenomyitis.
- B. Acute prostatitis.
- C. Paraproctitis.
- D. Prostate cancer.
- E. Abscess of the prostate.

11. A 64-year-old patient is hospitalized with complaints of difficulty urinating. 20 hours ago the patient had complete urinary retention. Catheter removed

800 ml of urine, without blood impurities. An enlarged bladder is palpated above the pelvis. What are the primary diagnostic methods?

- A. Excretory urography with descending cystography.
- B. Computed tomography.
- C. Ultrasound tomography.
- D. Cystoscopy.
- E. Rectal examination of the prostate gland.

12. A 42-year-old patient complains of paroxysmal pain in the right lumbar region, which irradiates to the right half of the urethra, nausea, frequent urge to urinate. He fell ill acutely, an hour ago. Blood: leukocyte count: 7.4×10^9 , bacillus -7, ESR-22, erythrocyte count -3.6×10^9 . Urine analysis: protein 0.033%, leukocyte 10-12, serum 30-40. Your diagnosis?

- A. Renal colic.
- B. Urolithiasis.
- C. Hepatic colic.
- D. Ectopic pregnancy.
- E. Acute cholecystopancreatitis.

13. A 47-year-old patient after falling from a height felt a sharp pain in the lower back, when urinating she noticed red color of urine. In urine analysis - hematuria, X-ray ultrasonography of the kidneys did not reveal pathology. What is your diagnosis?

- A. Acute pyelonephritis.
- B. Acute cystitis.

- C. Adenoma of the prostate gland.
- D. Bruise of the kidney.
- E. Damage to the urinary tract.

14. A 44-year-old patient with a broken pelvic bone was hospitalized in the department. A few hours later he began to complain about the inability to urinate while maintaining the urge, pain in the suprapubic area. On examination, a full bladder is noticed. What is the most possible preliminary diagnosis?

- A. Acute pyelonephritis.
- B. Prostate adenoma.
- C. Acute prostatitis.
- D. Acute cystitis.
- E. Urethral trauma.

15. A 44-year-old patient with pelvic bone fracture was admitted to the department. A few hours later he complained of inability to urinate with preserved urge, pain in the suprapubic area. On examination, he had a full bladder, urethrorrhagia, hemorrhage in the perineum. The preliminary diagnosis is urethral rupture. What emergency care should be provided?

- A. Perform an epicystostomy.
- B. Analgesic therapy.
- C. Antispasmodic therapy.
- D. Catheterization of the urethra.
- E. Anti-inflammatory therapy.

16. A 32-year-old patient was hit by a car. She complains of pain in the lower abdomen and above the pubis with radiation to the perineum and rectum, frequent, difficult and painful urination in small portions, blood impurities in the urine. Objective examination reveals tension over the pubis, percussion - blunted percussion sound. What is the preliminary diagnosis?

- A. Kidney rupture.
- B. Extraperitoneal rupture of the bladder.
- C. Urethral rupture.
- D. Rupture of the ureter.
- E. Kidney contusion.

17. The patient complains of intense pain in the left lumbar region, fever accompanied by fever up to 38 ° C. The abdomen is soft, painful in the left flank. Palpation of the kidney area is painful on the left. Blood test: L - $28.0 \times 10^9 / l$, ESR - 63 mm / h. Urine test: acid reaction, L - the entire field of view. According to the ultrasound - the right kidney without features, the contours of the left kidney are enlarged, the ureter is dilated. What disease can be thought of?

- A. Tumor of the left kidney.
- B. Tuberculosis of the left kidney.
- C. Left-sided paranephritis.
- D. Polycystic kidney degeneration.
- E. Acute purulent left-sided pyelonephritis.

18. A 42-year-old patient was admitted to the emergency department with a diagnosis of renal colic. Which of the following signs is most likely for the patient?

- A. Leukocytosis.
- B. Hematuria.
- C. The presence of sugar in the urine.
- D. Bilirubinemia.
- E. Decrease in red blood count.

19. A 20-year-old patient complains of frequent urination, false urge to urinate, pain that increases during urination. In the last portion of urine there are several drops of blood. He gets sick after hypothermia. This happened three times last year. Body temperature is normal. Urine is cloudy, on examination: leukocytes - large number in the field of view, protein - 0.099 g/l. What disease should we think about?

- A. Acute cystitis.
- B. Exacerbation of chronic para cystitis.
- C. Bladder tumor.
- D. Acute urethritis.
- E. Chronic cystitis in the acute stage.

20. The patient was in a car accident, diagnosed multiple fractures of the anterior pelvic hemisphere with damage to the urethra and acute urinary retention. An enlarged bladder is palpated above the pelvis. What help is indicated in this case?

- A. Bladder catheterization with a soft catheter.
- B. Catheterization of the bladder with a metal catheter.
- C. Epicystostomy.
- D. Capillary puncture of the bladder.
- E. Intrapelvic novocaine blockade.

CORRECT ANSWERS

"Emergency care in urological diseases"

1		6		11		16	
2		7		12		17	
3		8		13		18	
4		9		14		19	
5		10		15		20	

SECTION III

INTERRELATION OF URINARY SYSTEM DISEASES WITH DISEASES OF OTHER SYSTEMS AND ORGANS

3.1. Lung condition in some kidney diseases

In generalized lesions of the renal parenchyma, which occur in diseases such as acute renal failure, glomerulonephritis and others, radiological manifestations have much in common.

Radiological examination of the abdomen usually begins with a plain radiography of the chest cavity and a targeted study of the state of the border thoracoabdominal zone.

In acute diseases of the upper abdominal cavity, a thoracic syndrome may be observed, which combines a number of radiation symptoms: high standing and restriction of diaphragm mobility, secondary pleurisy, changes in the basal lungs.

The determination of the state of water balance by X-ray examination of the lungs is crucial for the diagnosis of acute renal failure.

On the examination radiograph in case of pulmonary edema, usually bilateral extensive changes of the lungs are noted.

Peripheral parts of the lungs are free from lesions. Changes are localized in the central parts of each lobe and have a characteristic appearance - butterfly edema: foci of darkening in the central parts of the lungs surrounded by a free zone of normal parenchyma. These shadows express increased permeability of dilated alveolar capillaries, which leads to the so-called water lung. In 35% of observations in renal failure, pulmonary edema is accompanied by pleural effusion. These radiological signs are earlier than peripheral edema. Along with pulmonary edema, the plain

radiograph of the abdomen shows signs of edema of the retroperitoneal tissue and kidneys. At the same time, the density of the retroperitoneal space increases, as a result of which it is impossible to detect the shadows of the lumbar muscles and kidneys.

Kidney enlargement can be due to both urinary stasis and extensive parenchymal changes.

The results of the plain radiography dictate the decision-making algorithm.

3.2. Skeleton condition in diseases of urinary tract organs

Description of the image of the urinary system organs is carried out in relation to individual bones that have a permanent location. The most permanent landmark is the spine, so the study of X-ray images begins with the bone system; lumbar and lower thoracic vertebrae, ribs, pelvic bones. This is dictated by the fact that the disease processes in diseases of the urinary tract are accompanied by symptomatic scoliosis, indicating the pathology of the urinary tract.

Changes in the bones can be the result of diseases of the urinary system, i.e. secondary, as well as independent - primary. Secondary lesions of skeletal bones can be caused by metastases of hypernephroid kidney cancer or prostate cancer. Often, the type of tumor and its primary focus can be recognized by the localization and nature of bone metastases. Thus, the diagnosis of prostate cancer is made in the presence of characteristic bone metastases when the disease is not clinically manifested. Prostate and kidney cancer cells more often metastasize to the lumbar vertebrae, ribs, pelvic bones. Bone metastases are osteoclastic (lytic) and osteoblastic (sclerotic). Osteolytic metastases are more common. On radiographs, they are characterized by oval structureless defects of various sizes without foci of decay with scalloped contours. Osteolytic metastases in vertebral bodies cause their compression.

Osteoblastic metastases are characterized by uniform intense bone tissue. In these cases, irregularly shaped, merging lesions appear on the background of normal spongy bone structure. They are called cancerous osteosclerosis. Such marbling of bones is typical for prostate cancer metastases. In osteoblastic metastases, pathological bone fractures are less common. Osteolytic and osteoblastic metastases can be combined in the same patient.

Pathological changes in bones can be caused by degenerative lesions, which are clinically manifested by low back pain, similar to the symptoms of kidney disease. In such cases, radiation signs of deforming osteochondrosis, spondylitis, spondyloarthritis, spinal tuberculosis can be seen on X-rays.

3.3. State of the vascular system in kidney diseases

Diseases of the kidneys and their vessels can cause the development of nephrogenic arterial hypertension. One of its causes is a violation of arterial blood flow to the kidney due to atherosclerosis or kinking of the artery in nephroptosis. This is renovascular hypertension. Another reason is a violation of intrahepatic blood flow in glomerulonephritis or chronic pyelonephritis. This form of hypertension is called parenchymal hypertension.

The first level of radiation diagnostics is limited to urography and renography. If possible, the second level is used, in which the study is carried out in two stages. At the first stage, sonography, CT, diagnostic scintigraphy are performed. These methods allow to find out the anatomical and functional state of the kidneys and select patients with the genesis of the presumed disease. At the second stage, in nephrogenic hypertension, angiography with digital subtraction is performed.

3.4. Kidneys in patients with diabetes mellitus

The ratio of length, width and thickness of the kidneys is normal - 2:1:0.8. Changes in these dimensions are a frequent and specific sign of diffuse renal pathology. The most informative is the ratio of the width and thickness of the kidneys, which in the presence of a number of nephropathies is close to 1 ("symptom 1"). Normally, this ratio is less than or equal to 0.8. This symptom can be detected with minimal manifestations of nephropathy. It is often detected in patients with type 2 diabetes, sometimes even before the clinical manifestations of nephropathy. In this case, the width and thickness of the kidney are almost equal, so the kidney is round in cross-section.

SECTION IV

RADIATION DIAGNOSTICS IN EMERGENCY UROLOGY

The main principle of emergency radiation diagnostics of diseases and injuries of the retroperitoneal organs is to obtain maximum information using a minimum number of methods.

Preliminary diagnosis dictates the optimal sequence of using radiation diagnostic methods, which involves examination of the patient in two stages. First of all, in acute diseases of the urinary system, generally available methods are used, which often independently solve the diagnostic problem. If necessary, the second stage uses a set of more complex methods of radiation research: CT, MRI.

One of the decisive factors in choosing the method of radiation examination of the patient is its practical availability, which remains the advantage of traditional *examination radiography*. X-ray examination does not lose its importance, but requires accurate use of technology. Overview X-ray of the abdominal cavity allows to quickly obtain a one-stage panoramic examination of the abdomen with a small radiation load and to give a comparative assessment of all its organs and diaphragm, that is, to carry out screening.

Along with X-ray method, urinary tract examination can be performed by ultrasound. Ultrasound is very useful in the stage of *non-functioning* kidney, when other methods of radiation diagnostics are not informative. At the same time, ultrasound in urgent diagnostics can have negative aspects. Thus, we do not get a simultaneous panoramic image of the entire abdominal cavity. In addition, in case of abdominal injuries it may be difficult to contact the sensor with its walls.

Emergency X-ray examination is performed for *differential diagnosis of renal colic and acute abdominal diseases*. It begins with an examination image, which allows you to quickly establish the causes of pain. The advantage of the

overview image is the coverage of all urinary tracts on both sides. It shows a number of indirect signs that indicate the presence of renal colic:

1. Symptomatic scoliosis curved to the diseased side.
2. Enhancement of the shadow of the contracted lumbar muscle (as a manifestation of muscle protection).
3. Segmental intestinal paresis with maximum gas accumulation on the side of the disease.
4. Comparable increase and compaction of the kidney shadow, due to venous stasis of the kidney.
5. Zone of rarefaction around the kidney as a consequence of edema of the paranephric tissue.
6. The presence of a clear contour of the kidney due to the halo of rarefaction.
7. Homogeneous shadow of the entire renal area without differentiated image of the kidney due to severe paraneural edema in prolonged renal colic.

At the same time, small X-ray-negative stones on the background of aerocolic characteristic of colic are not always differentiated on the image. In such cases, additional research methods are used, but without special preparation of the patient's intestine due to the need for emergency examination.

Excretory urography has great diagnostic possibilities in renal colic. When applying this method, various radiological signs are observed: hyperkinesis of the urinary tract on the healthy side and, consequently, accelerated urine passage; at the same time - a longer excretion of contrast agent by a healthy kidney than normal, so early images are taken (3-4 minutes after the introduction of contrast). At the height of renal colic, the absence of contrast agent in the calyx and pelvis in the diseased kidney is noted. At the same time, the nephrogram is clear: the shadow of the kidney

is enhanced due to the good functional state of the parenchyma, which is imbibed by the contrast agent. The presence of nephrogram and absence of contrast agent in the upper urinary tract is evidence of renal colic.

The absence of dilation of the ureter and collecting system of the kidney at the height of the pain attack excludes the diagnosis of renal colic.

In case of suspicion of *tumors* in emergency cases, at the first stage of the study, an X-ray of the kidneys and urinary tract is performed without preparing the patient. Already on the examination image, an increase in the kidney and deformation of its contour, and sometimes small deposits of lime in the tumor can be diagnosed. Depending on the results of the first stage, the second stage is carried out as planned.

Radiation examination of the urinary tract in urgent urology should be accompanied by a plain radiography of the chest cavity with a targeted study of the thoracoabdominal area.

Compliance with these conditions significantly increases the diagnostic capabilities of the method and allows to detect a complex of specific syndromes of abdominal cavity pathology on a regular examination image in conditions of natural contrast.

Radiation examination of the urinary tract in emergency cases is performed at the height of clinical manifestations immediately upon admission of the patient to the hospital, without special preparation. And it is compulsorily supplemented by screening examination of other abdominal organs.

Filling of the bladder contributes to the informativeness of examination radiography and sonography. For examination of urinary organs by ultrasonography the optimal bladder volume is 200-300 ml. The presence of 300-500 ml in the bladder leads to physiological hypertension in the upper urinary tract, which facilitates the examination of the ureters.

Radiation examination is carried out in two stages: first - screening examination of the abdominal organs, and then - study of the urinary tract.

4.1 Kidney damage

When blunt force is applied to the kidney area, closed injuries may occur. The degree of damage depends on the intensity of the force, the position and fixation of the kidneys, and the thickness of the fat capsule. The mobile kidney, surrounded by a pronounced fat capsule, is more protected from damage. It can slip away from the force, and the fatty tissue of the capsule, taking on the impact, absorbs it.

Various pathological conditions of the kidneys (hydronephrosis, cyst, horseshoe kidney) contribute to the damage of this organ during trauma.

Damage can cause peri-renal hemorrhage, superficial damage to the parenchyma, partial rupture of the renal sinus, complete rupture of the kidney and its capsule, damage to the renal sulcus, detachment of the kidney from the renal pedicle. In severe injuries, kidney function stops.

Some signs of kidney damage can be detected on the examination image. In peri-renal hematoma, the contours of the lumbar muscle and kidney are blurred due to blood infiltration of retroperitoneal adipose tissue. In subcapsular rupture the kidney shadow is enlarged, there is a bulge on its contour. The shadow of the kidney is not differentiated due to significant retroperitoneal hemorrhage into the perirenal tissue in case of rupture of the renal capsule and renal pedicle. In addition, there is a high position of the diaphragm dome on the affected side.

Indirect signs indicating possible kidney damage are fractures of the lower ribs, transverse processes of the lumbar vertebrae. These X-ray symptoms in the presence of trauma and appropriate clinical manifestations should be used for diagnostic purposes.

Objective diagnostics of kidney damage is provided by selective intravenous urography, which simultaneously determines the condition of the intact kidney. Methods: after intravenous administration of contrast agent in 5-7 minutes the first image is taken, in 10-15 minutes - the second. If necessary, the third picture is taken in 25-30 minutes. Images are taken on a 30x40cm film with the X-ray beam centered on the navel area.

If the excretory function of the kidney is preserved, it is possible to obtain information about the renal cavity system: pelvis, calyx, sinus. Damage to the pelvis and calyx leads to deformation of their contours. Depending on the degree of rupture, contrast agent appears in the renal parenchyma.

Blood clots cause filling defects in the excretory system.

If the kidney does not function in case of its damage, low blood pressure or shock, retrograde pyelography is necessary. Contrast agent that enters the retroperitoneal space is quickly excreted from the body.

Depending on the nature of the injury, the X-ray picture during retrograde filling is different. In case of incomplete rupture, only the calyces that retained connection with the renal pelvis are filled. Part of the contrast agent enters the parenchyma. In case of complete rupture, the contrast agent may surround the entire kidney. In case of simultaneous rupture of the kidney parenchyma and its capsule, the contrast agent is distributed in the perirenal adipose tissue. With a sharp rupture of the renal pedicle, the pelvis and calyx are not filled with contrast. If only renal vessels are ruptured, filling of pelvis and calyx may remain normal.

In a damaged kidney, late complications may occur in a few months: stone formation, hydronephrosis, kidney wrinkling, cystic kidney.

4.2. Bladder damage

Bladder injuries often occur with fractures of the pelvic bones and require immediate surgical intervention.

Ruptures of the urinary bladder can be extraperitoneal, intraperitoneal, mixed, and can also be combined with damage to other organs.

An extraperitoneal rupture occurs when the bladder is moderately full, when it almost does not protrude above the symphysis. The lower part of the bladder, facing the pliable muscular floor, is torn by a force acting from the front, from above, to the back and down.

An intraperitoneal rupture occurs with an overfilled bladder, when a sudden force causes a hydraulic shock of urine with a rupture of the bladder in the most anatomically weak place - the posterior superior wall.

Mixed tears occur under the influence of significant force, have a complex mechanism, and can be combined with fractures of the pelvic bones.

Retrograde cystography with the introduction of contrast fluids prepared under strict aseptic conditions is used to diagnose ruptures. A prerequisite should be sufficient filling of the bladder, as a small amount of liquid will not get into the surrounding tissues. For better detection of contrast fluid in the abdominal cavity, cystography is performed with the raised leg end of the table or gurney.

After filling the bladder with a contrast solution, 3 pictures are taken: in a direct posterior projection; in an oblique projection with the patient turned on his side at an angle of 40-45*; posterior direct view of the bladder after its emptying from the injected contrast solution.

The beam is centered 2-3 cm above the symphysis.

When analyzing cystograms, attention is paid to the position of the bladder, its shape, measurements, contours, presence of contrast along the contours of the bladder. In the presence of adhesions, note the nature of the spread of the contrast agent and its localization.

Polypositional imaging of the bladder allows to clarify the localization of the rupture: in front, behind, in the upper parts, near the neck, etc.

Delayed images allow detection of the flow of contrast outside the bladder due to increased pressure in the bladder due to secreted urine.

Intravenous urography with descending cystography is required for simultaneous damage to the urethra and bladder, if the patient is not in shock. In patients in a state of shock, kidney function is sharply suppressed and the method is ineffective. At the same time, the concentration of radiopaque substances in the urinary bladder does not exceed 5%, which makes it difficult to detect X-ray symptoms of bladder damage.

X-ray symptoms of bladder damage obtained during cystography make it possible to choose the correct operative method. There are direct and indirect signs of bladder rupture. A direct sign: the presence of an injected contrast solution in the abdominal cavity or in the peribladder tissue. Indirect signs: displacement of the bladder and its various deformations.

The presence of a contrast agent in the peribladder tissue is the main X-ray sign of an *extraperitoneal* rupture. Depending on the size and localization of the rupture of the urinary bladder, the amount of contrast and its localization may be different. With small tears in the front wall of the bladder near the neck, the contrast agent is localized in the peribladder tissue at the base of the bladder. The displacement of the bubble is insignificant, the deformation is expressed in some of its elongation.

In the case of small tears of the upper wall (up to 5 cm) in the upper parts of the bladder, the contrast substance is located above it in the form of a massive shadow with uneven contours.

With large tears of the front wall (7-13 cm), the bladder is not deformed on the images, the contrast material is presented as an intense massive shadow with a convex aerchyal border up to the level of the L₄ body.

After emptying the bladder, the contrast shadow does not change its image in the picture.

When the rupture is localized on the side wall, the contrast agent on cystograms is located on one side. The bladder is displaced in the opposite direction, and its corresponding wall is flattened.

X-ray symptoms are more pronounced when the front side wall is torn near the neck of the bladder: the bladder is sharply deformed, may have the shape of an elongated oval, the upper pole may reach the upper edge of the L₅ body, the longitudinal size of the bladder may exceed its diameter by 2-3 times. With such ruptures, the bladder moves to the opposite side of the rupture and upwards. The contrast substance in the form of a cloud-like shadow is determined in the peribladder tissue near the neck of the bladder.

Thus, with extraperitoneal ruptures of the urinary bladder, the paravesicular hematoma causes a pronounced deformation of the organ, most pronounced with ruptures of the anterolateral wall near the neck of the bladder, where the vascular network is most developed. The convexity of the upper border of the spilled contrast indicates its subperitoneal location.

Intraperitoneal ruptures of the bladder are characterized by the spread of contrast fluid from the bladder into the abdominal cavity. Displacement and deformation of the bladder with this type of rupture are less pronounced.

Contrast material in the abdominal cavity usually spreads through the lateral channels. When the back wall is damaged, the contrast accumulates in the space behind the bladder and is determined on the images above the shadow of the bladder, which is well observed after urination.

Less often, the contrast material is located between the intestinal loops. Contrasting shadows of an irregular shape between the gas-inflated intestinal loops are determined on the images.

Conditionally, we can talk about the small size of the gap (1-1.5 cm), medium (4-5 cm) and large (10-15 cm). The larger the gap, the smaller the size of the bladder and the more contrast fluid in the abdominal cavity.

In case of *a mixed rupture* of the urinary bladder, the X-ray picture depends on the size of the extraperitoneal and intraperitoneal ruptures and on the position of the catheter. After emptying the bladder, the location of the contrast liquid and its intensity practically do not change.

Since the free abdominal cavity offers less resistance to the outflow of fluid than the peribladder tissue, with a mixed rupture, the contrast mass flows to a greater extent into the abdominal cavity.

Bladder hematoma is usually determined in the area of a pelvic bone fracture and is determined on X-rays by indirect symptoms: displacement and deformation of the bladder. On cystograms, the bladder moves in the opposite direction, and its deformation can be very diverse.

If, after emptying the bladder, the contrast solution is not detected in the peribladder tissue, then there is no damage to the bladder and there is no need for surgical intervention.



45 Yellowthroat
1834
11.22.88



TEST TASKS

Radiation diagnostics in emergency urology.

1. The leading method of diagnosing CKD is:
 - A. Radioisotope research methods
 - B. Laboratory research methods
 - C. X-ray research methods

2. With intact kidney function, it is better to study the functional-anatomical state of the kidneys on the excretory urogram by:
 - A. 90 - 120 min.

B. 1st and 2nd min.

C. 5 - 15 minutes.

D. 2 - 120 min.

E. 40 and 50 sec.

3. The main method of diagnosing urethral tears is:

A. IV urography

B. Cystography

C. Ascending urethrography

4. Which method is best to study kidney function in urological patients?

A. Excretory urography

B. Isotope renography of kidneys

C. Level of residual blood nitrogen

5. In a vertical position, the patient's kidneys are palpated. What urography will you prescribe?

A. Infusion

B. Orthostatic

C. Compression

6. Radioisotope scanning of the kidneys is prescribed for which kidney diseases?

A. Nephroptosis

B. Double kidney bowls

C. Duplication of the ureters

D. Paranephritis

E. For those diseases that occur with a decrease in the amount of functioning parenchyma.

7. The most informative method in the differential diagnosis of nephroptosis and kidney dystopia:

A. Arteriography

B. Retrograde pyelography

C. Isotope rheography

8. By which method is it possible to study the anatomical and morphological state of the kidneys?

A. Isotope renography of kidneys

B. Survey urography

C. Ultrasound examination of kidneys

9. Which of the methods will help in the differential diagnosis of renal colic and acute surgical pathology?

A. Overview R-scopy of the abdominal cavity

B. Chromocystoscopy

C. R-scopy of chest organs

10. For retrograde cystography in case of rupture of the bladder, use:

A. Triatomic liquid radiopaque substances

B. Oxygen

C. Barium sulfate

11. For the diagnosis of kidney injury, it is shown:

A. IV urography

B. Radioisotope renography

C. Kidney scan

12. For retrograde cystography in case of suspected bladder rupture, it is necessary:

A. Administration of up to 50 ml of contrast material

B. Administration of up to 150 ml of contrast material

C. Tight filling of the bladder

13. The most informative method in the differential diagnosis of nephroptosis and kidney dystopia:

A. Arteriography

B. Retrograde pyelography

C. Isotope renography

14. The most reliable diagnostic methods for cross-distopia of the kidneys:

A. Ultrasound

B. Angiography

C. Excretory urography

D. Retrograde urethrography

15. The most accurate modern method of diagnosing the functional state of each kidney separately:

- A. Ultrasound scanning
- B. Rheorenography
- C. Radioisotope renography

16. The most informative method of evaluating the urodynamics of the upper urinary tract:

- A. Chromocystoscopy
- B. Excretory urography
- C. Electromyography of bowels and ureters

17. The most accurate method of studying urodynamics of the upper urinary tract:

- A. Survey urography
- B. X-ray television urography
- C. Chromocystoscopy

18. The most important contraindication to excretory urography:

- A. Increased sensitivity to iodine
- B. Shock
- C. Collapse

19. Contraindications to retrograde ureteropyelography:

- A. Acute urethritis, acute prostatitis
- B. Tuberculosis of the urinary system

C. General weakness

20. The optimal amount of contrast material for excretory urography:

A. 20 mg/kg

B. 2 - 3 mg/kg

C. 5 mg/kg

21. The most characteristic signs of kidney tumors on the excretory urogram:

A. Deformations of the cup-bowl system and convexity of the contour

B. Absence of contrast selection

C. Bumpiness of the contour

22. In acute primary pyelonephritis, the excretory urogram reveals:

A. Lumbar muscle shadow

B. Normal or slightly reduced kidney function

C. Reduction of the kidney.

CORRECT ANSWERS

1		7		13		18	
2		8		14		19	
3		9		15		20	
4		10		15		21	
5		11		16		22	
6		12		17			

RECOMMENDED LITERATURE

Basic

1. Urology : national textbook for students of higher medical educational institutions of the IVth levels of accreditation level / S. P. Pasiechnikov [et al.] ; ed. by: S. P. Pasiechnikov. - Vinnytsia : Nova Knyha, 2019. - 400 p.
2. Vozianov S.O., Gubar A. O. Stone disease // K: 7 БІІ, 2022. – 160 c.

Additional

1. Ahuja A. T., Antonio G. E., Wong K. T. Case studies in medical imaging. Radiology for students and trainees, 2006.
2. David Sutton - Textbook of Radiology and Imaging. seventh edition 2003, p.885.
3. Higgins C.B., Hricak H., Helms C.JI. Magnetic resonance imaging of the body. 2nd ed.— NewYork: RavenPress, 1992.
4. Hugue Ouellette, M.D.; Patrice Tetreault, M.D. Clinical radiology made ridiculously simple. 2000, p.108
5. Kovalsky O., Mechev D., Danilevych V. Radiology. Radiotherapy. Diagnostic imaging. Vinnitsia 2013.
6. Michael Y.M.Chen, Thomas L. Pope, David J. Ott - Basic radiology. second edition 2004, p.233
7. Manual of Medical Treatment in Urology / ed. by.: Ismaila A. Mungadi, Hyacinth N. Mbibu, E. Eltahawy. - India : Jaypee Brothers Medical Publishers (P) Ltd, 2014. - 162 p. -
8. Moeller, Torsten B. Normal findings in CT and MRI. 2000, p. 250

9. Medical radiology. Radiation oncology. Editors: L. W. Brady, Philadelphia H.-P. Heilmann, Hamburg M. Molls, Munich Technical basis of radiation therapy. Springer-Verlag Berlin Heidelberg 2006.
10. Nordio E. G. Radiological investigation of the urogenital system : tutorial on radiology for students of the international medical faculty / E. G. Nordio. - Zaporizhzhia : ZSMU, 2018. – 108 p.
11. Paul Butler, Adam W. M. Mitchell and Harold Ellis Applied radiological anatomy for medical students. 2007p.159
12. Probert J.L., Glew D. and Gillat D.A. Urological tests in clinical practice kidney International, Vol. 41 (1992), p. 445-449.
13. Silverman, Stuart G.; Cohan, Richard H. CT Urography an Atlas., 1st Edition 2007 , p. 273.
14. Urology. E.M.Shimkus,S.E.Shimkus./Simferopol, IAD CSMU, 2005.

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ
ЗАПОРІЗЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ
КАФЕДРА УРОЛОГІЇ

Г. В. Бачурін, Ю. С. Коломоєць

**ТРАВМАТИЧНІ УШКОДЖЕННЯ ОРГАНІВ
СЕЧОВИДІЛЬНОЇ ТА ЧОЛОВІЧОЇ СТАТЕВОЇ
СИСТЕМИ**

НАВЧАЛЬНИЙ ПОСІБНИК

Запоріжжя

2023

УДК 616.6(075.8)

Б 32

Рекомендовано до видання Центральною методичною радою
Запорізького державного медичного університету
(протокол № від 2023 р.)

Автори:

Г. В. Бачурін – завідувач кафедри урології ЗДМУ, доктор медичних наук, професор;

Ю.С. Коломоєць – асистент кафедри урології ЗДМУ, кандидат медичних наук.

Рецензенти:

О. В. Капшитар – професор кафедри загальної хірургії та післядипломної хірургічної освіти ЗДМУ, доктор медичних наук, професор;

В. І. Перцов – завідувач кафедри медицини катастроф, військової медицини та нейрохірургії ЗДМУ, доктор медичних наук, професор.

Бачурін Г. В., Коломоєць Ю.С.

Травматичні ушкодження органів сечовидільної та чоловічої статеві системи: навч. посібник / Г. В. Бачурін, Коломоєць Ю.С. – Запоріжжя: ЗДМУ, 2023. – 106 с.

У навчальное посібнику для студентів IV курсів II міжнародного факультету за спеціальністю «Медицина» представлено теоретичний матеріал за темою, практичні завдання та тестовий контроль знань.

УДК 616.6(075.8)

© Г.В. Бачурін, Ю.С. Коломоєць, 2023

© Запорізький державний медичний університет, 2023