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Suggestions for Introducing Some New Terms in Pelvic and Acetabular Surgery

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Abstract

Background. The rapid advancement of modern surgical methods for treating pelvic bone fractures has underscored the necessity for developing a new terminological framework. This is because the classical anatomical terminology of the pelvis no longer aligns with the demands of the therapeutic process and scientific research in this field. The traditional set of anatomical names and landmarks falls short in providing detailed descriptions of all intricacies of injuries when employing contemporary surgical techniques. The existing terminology system needs to catch up with the level of contemporary pelvic surgery, enabling a comprehensive and understandable characterization of existing pathology and the treatment being administered for all medical professionals.

Purpose of the study was to create names for certain parts of the pelvic bones and their areas that currently lack specific designations and to propose the developed terms for professional discussion.

Methods. A retrospective analysis was conducted on X-rays and computer tomography scans of patients with pelvic bone injuries, performed from 2020 to 2022. A list of potential new anatomical terms was compiled through a literature review.

Results. In several cases, we encountered a deficiency of terms in diagnosing pelvic injuries and describing surgical procedures. New terms were developed to denote areas of the pelvis and their injuries, including the pubic bone base, vertical fractures of the pubic bone base, longitudinal fractures of the pubic bone base, incomplete rupture of the pubic symphysis, the base of the ilium, longitudinal fracture of the iliac base, fracture-subluxation and fracture-dislocation of the iliac base, calcar of the iliac bone, calcar spike, and the bone corridor.

Conclusions. The incorporation of new anatomical terms into clinical practice will help enhance the precision of diagnosis and surgical planning in pelvic fractures. Standardizing the terminology will promote uniformity in approaches and knowledge sharing among specialists, ultimately improving the quality of surgical care for patients with pelvic injuries.

Keywords: pelvic fracture, pubic bone, pubic symphysis, bone corridor, pelvic bone, acetabulum, sciatic buttress, sacroiliac joint.

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Предложения по введению некоторых новых терминов в хирургию таза и вертлужной впадины

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Реферат

Актуальность. Стремительное развитие современных хирургических методов лечения переломов костей таза выявило необходимость разработки нового терминологического аппарата, так как классическая анатомическая терминология таза перестала соответствовать запросам лечебного процесса и научных исследований в данной области. Классический набор анатомических названий и ориентиров не позволяет детально описывать все нюансы повреждений при применении современных хирургических методик. Имеющееся отставание системы терминов от уровня современной тазовой хирургии должно быть устранено для возможности подробно и понятно для всех специалистов характеризовать имеющуюся патологию и проводимое лечение.

Цель исследования — разработать названия для некоторых частей костей таза и его областей, которые до настоящего времени не имеют своих обозначений, и предложить разработанные термины для профессионального обсуждения.

Материал и методы. Выполнен ретроспективный анализ рентгенограмм и компьютерных томограмм пациентов с повреждением костей таза, выполненных с 2020 по 2022 г. В результате анализа литературы был составлен список потенциальных новых анатомических терминов.

Результаты. В ряде случаев мы столкнулись с дефицитом терминов при диагностике повреждений таза и описании хода операций. Разработаны новые термины для обозначения областей таза и их повреждений: основание лобковой кости, вертикальные переломы основания лобковой кости, продольные переломы основания лобковой кости, неполный разрыв лобкового симфиза, основание подвздошной кости, продольный перелом основания подвздошной кости, переломоподвывих и переломовывих основания подвздошной кости, калькар подвздошной кости, калькарный шип, костный коридор.

Заключение. Внедрение новых анатомических терминов в клиническую практику поможет улучшить точность диагностики и планирования хирургических вмешательств в тазовой области. Стандартизация терминологии будет содействовать единообразию подходов и обмену опытом между специалистами, что послужит повышению качества хирургического лечения пациентов с повреждениями таза.

Ключевые слова: переломы таза, лобковая кость, лобковый симфиз, костный коридор, тазовая кость, вертлужная впадина, sciatic buttress, крестцово-подвздошное сочленение.

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BACKGROUND

Up until the 1970s, a conservative approach overwhelmingly dominated the treatment of pelvic ring injuries. The non-operative treatment process didn't involve a wide variety of methods, and the classical anatomical terminology used in the preoperative period adequately met the demands of the therapeutic process.

Starting in the early 1980s, there was a radical shift in the paradigm. Advancements in knowledge and technological progress in medicine led to a complete change in the approach to treating pelvic injuries. Specialists transitioned from a predominantly conservative approach to active surgical treatment for most types of pelvic ring fractures. The emergence and active development of precise diagnostic methods, a multitude of new surgical techniques, and procedures required a more detailed analysis of fracture characteristics and the description of the surgeon's actions. Specialists felt an acute need to name many parts of the pelvis that previously lacked approved names in the anatomical nomenclature (and didn't even have unofficial designations within the professional community).

The existing "terminological inadequacy" also has a cross-linguistic aspect. It's not uncommon for situations where foreign terms lack equivalents in the Russian-speaking field, and vice versa. These circumstances served as the basis for developing missing anatomical terms and publishing this study.

Purpose of the study was to create names for certain parts of the pelvic bones and their areas that currently lack specific designations and to propose the developed terms for professional discussion.

METHODS

The research retrospectively analyzed the data of X-rays and CT scans of patients who underwent examination and treatment at the State Budgetary Healthcare Institution of Moscow "N.V. Sklifosovsky Research Institute for Emergency Medicine" of the Moscow Health Department for pelvic bone injuries during the period from January 1, 2020, to December 31, 2022.

A list of potential new anatomical terms necessary for describing anatomical structures and their features was compiled through a literature review.

Definitions were refined and terminology was clarified, taking into account various approaches and international standards. The proposed anatomical terms were validated through real clinical cases and anatomical specimens. They were used during surgeries and in the analysis of medical data to determine their applicability and convenience in clinical practice.

The study was conducted in compliance with the principles of voluntary patient consent and the confidentiality of medical data. When evaluating the data, coded anonymous information was used, without disclosing personal patient information.

RESULTS AND DISCUSSION

The complex geometry of the pelvic bones gives rise to numerous anatomical structures and their respective names (terminology). However, "blank spots" and inconsistencies persist in anatomical nomenclature. The article is divided into three parts, each dedicated to the discussion of one anatomical region of the pelvis and its corresponding terms:

1) surgical anatomy of the pubic bone and symphysis;
2) the posterior aspect of the ilium;
3) intraosseous spaces of the flat bones of the pelvis.

These parts of the article provide the basis for the following new terms:

1) pubic bone base;
2) iliac base;
3) Iliac calcar;
4) calcar spike;
5) bone corridor.

We propose new terms to designate fractures of the pubic bone base based on the direction of lines in this area:

1) longitudinal fractures of the pubic bone base;
2) vertical transverse fractures of the pubic bone base.

Additionally, a simple classification of pubic symphysis ruptures is suggested based on the presence and direction of the fracture line of the pubic bone base:

– complete pubic symphysis rupture;
– incomplete pubic symphysis rupture.

A classification of injuries to the iliac base in cases of partial damage to the sacroiliac joint

(SIJ) is proposed, based on the direction of the fracture in the area of the iliac base:

– fracture-subluxation of the iliac base (+ A. Day classification) [1];

– fracture-dislocation of the iliac base (+ A. Day classification);

– longitudinal fracture of the iliac base.

1. Surgical anatomy of the pubic bone and symphysis

It is commonly believed that the pubic bone (os pubis) consists of three parts: the body (corpus ossis pubis), the superior branch (ramus superior ossis pubis), and the inferior branch (ramus inferior ossis pubis) [2]. However, a topographical confusion persists in modern anatomical atlases and textbooks. In English-language literature, the body of the pubic bone is described as being in the region of the pubic symphysis and forming the one. In contrast, in Russian-language literature, it is located in the acetabulum, presenting its anterior wall with a portion of the articular surface.

In foreign literature, the term «body» is defined as «the largest and most significant part of a bone, such as the diaphysis of long bones of the shoulder or femur» [3]. When it comes to the localization of the bodies of the iliac and ischial bones, foreign and Russian anatomists generally agree and define their topography in a similar way [1, 4]. However, when it comes to the pubic bone, the situation is less clear because the views of Russian and foreign experts differ significantly. In the foreign anatomical tradition, the «body» refers to the medial portion of the pubic bone, along with its superior and inferior rami [5, 6]. We could not find an explanation in the literature for why Western anatomists separate the body of the pubic bone topographically from the bodies of the iliac and ischial bones. Furthermore, the name for the lateral end of the upper branch of the pubic bone, which includes part of the articular cartilage of the acetabulum, remains unclear. Some foreign authors of anatomical atlases define it as the «anterior wall of the acetabulum» [7], while others do not address this topic at all [8].

The Russian anatomical tradition is notably more consistent in defining the term «body» of the pubic bone from an embryogenic and anatomical proximity perspective to similar structures [9]. «The pelvic bone, os coxae, is paired, and in children, it consists of three separate bones: the ilium, ischium, and pubis. In adults, these three bones fuse into a single pelvic bone. The bodies of these bones, by joining together, form the acetabulum on the outer surface of the pelvic bone. The ilium represents the upper part of the acetabulum, the ischium the posterior-inferior part, and the pubic bone the anterior-inferior part. During development, each of these bones develops independent ossification centers, so that until the age of 16-17, in the region of the acetabulum, the ilium, ischium, and pubic bone are joined by a Y-shaped cartilage. Subsequently, the cartilage ossifies, and the boundaries between the bones smooth out» [10]. In other words, if these bones, through their parts, form a single anatomical structure (the acetabulum), then these parts should also be named uniformly—in this specific case, as the «bodies» of all three pelvic bones (Fig. 1).

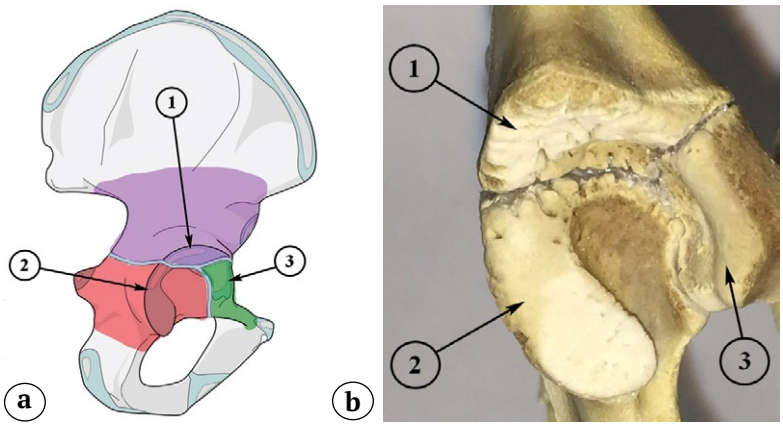


Fig. 1. Shaping of the acetabulum by joining the bodies of the iliac (1), sciatic (2) and pubic (3) bones (a); photo of the child's acetabulum, where the iliac, sciatic, and pubic bones are joined by the Y-shaped cartilage (b)

In the atlas of human anatomy by R.D. Sinelnikov, it is stated: "The body of the pubic bone, corpus ossis pubis, forms the anterior part of the acetabulum and directly continues into the upper branch, which extends forward, downward, and medially" [2]. However, a question arises in this context about the boundaries between the upper and lower branches: where does the upper branch end, and where does the lower branch begin? Which of the branches forms the pubic symphysis? From our perspective, these parameters are necessary for a detailed description of injuries in this area.

To bring clarity to this issue, we propose to divide the pubic bone not into three but into four parts and introduce the term "base".

Pubic bone base

We propose to designate the "base" as the part of the pubic bone that is located medially and forms the pubic symphysis. It has its boundaries:

– the medial boundary participates in forming the symphysis and determines its height;

– the lower boundary runs horizontally along the lower edge of the pubic symphysis and is perpendicular to the medial boundary;

– the lateral boundary follows the medial edge of the obturator foramen and is parallel to the medial boundary;

– the upper boundary is formed by the upper cortex of the pubic bone and includes the pubic tubercle (Fig. 2).

From the base of the pubic bone, the superior and inferior rami extend. At the lateral end of the superior ramus of the pubic bone is its «body,» which consists of bony mass participating in forming the anterior wall of the acetabulum with cartilaginous covering.

In our view, these terms will help in determining the localization and morphology of pubic bone fractures. According to Nakatani's classification, fractures in Zone I are located precisely in the area of the pubic bone's base [11, 12]. In attempts to objectify indications for the optimal treatment method for pelvic ring injuries, some researchers point out that all fractures in this area are the most unstable [13]. However, according to our observations, this is not always the case. Studying the nature of fractures, we divided them into two major groups: the first group includes lines that primarily run vertically, and the second group comprises fractures with lines that predominantly run horizontally and penetrate the pubic symphysis.

Through clinical observations and stress tests under anesthesia, we determined that vertical fractures are unstable and require surgical treatment, unlike horizontal fractures, which are relatively unstable. Vertical fractures can further be categorized into transverse and oblique. Transverse vertical fractures of the pubic bone's base have their fracture plane predominantly oriented in the sagittal plane (Fig. 3).

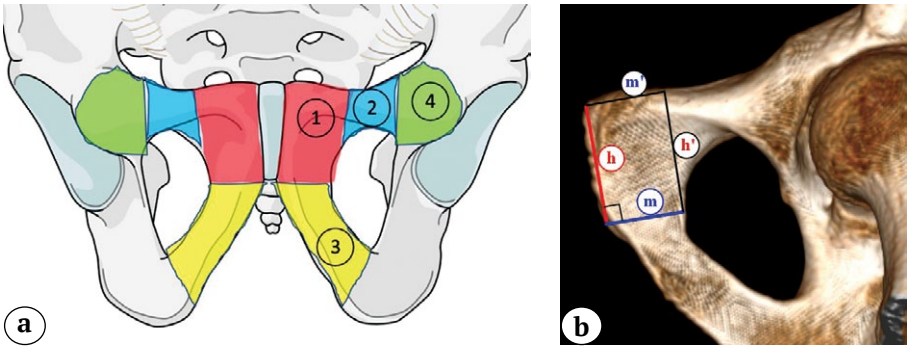


Fig. 2. Division of the pubic bone into four conventional regions:
1 — base; 2 — superior branch; 3 — inferior branch; 4 — body (a);
conventional boundaries of the base of the pubic bone: h — height of the base (red color),
m — width of the base (blue color). Black color indicates the remaining borders of the base h'and m',
which are the sides of the completed rectangle from the sides h and m (b)

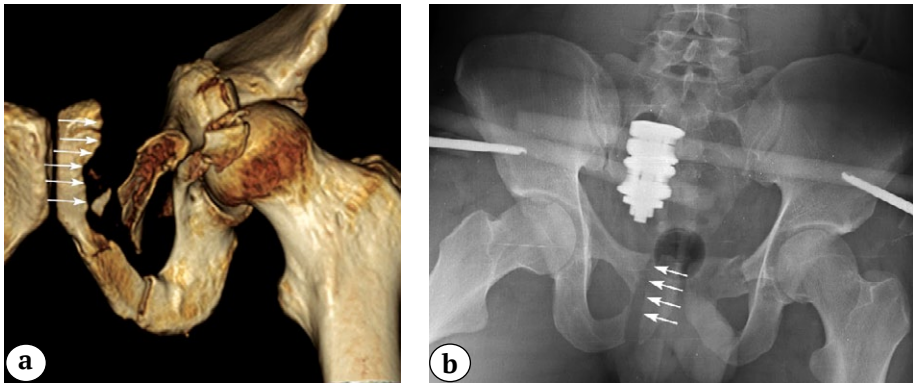


Fig. 3. Vertical transverse fracture of the base of the pubic bone (the arrows indicate the fracture lines):
a — 3D-CT image reconstruction;
b — pelvic X-ray in the AP view

Another type of unstable vertical fracture of the base is the oblique fracture. In this case, the fracture line runs along the base of the pubic bone without affecting the symphysis, forming a distinctive sharp end of the fragment (Fig. 4). We propose to refer to such fractures as «longitudinal fractures of the pubic bone's base.»

Such fractures can potentially be dangerous because the fragments may damage both the bladder and the venous plexus in the prevesical space when the pelvic ring is laterally compressed.

We propose new terms to describe vertical fractures of the pubic bone's base depending on the direction of the fracture lines:

– vertical transverse fractures of the pubic bone's base;

– longitudinal fractures of the pubic bone's base.

Horizontal fractures form the second major group of fractures that are relatively stable and typically do not require fixation. In our view, these fractures result from incomplete symphyseal disruption. The symphysis is surrounded by ligaments in the form of a cuff, where the upper and lower ligaments are the most robust, while the anterior and posterior ones are the weakest. Deforming forces on the front part of the pelvis lead to the disruption of the anterior symphyseal ligament, continuing to act on the base of the pubic bone in the form of horizontally oriented fractures (Fig. 5). Both the powerful upper and lower symphyseal ligaments can be damaged in the process (Fig. 6).

Thus, in addition to the well-known complete disruption of the symphysis, it is necessary to distinguish partial disruption of the symphysis in the presence of a horizontal fracture of the pubic bone's base. As a result, we propose a straightforward classification of pubic symphysis disruptions:

– incomplete disruption pubic symphysis (with or without displacement);

– complete disruption pubic symphysis (with or without displacement).

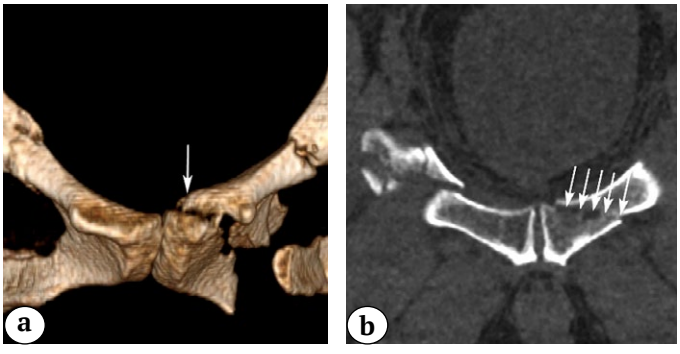
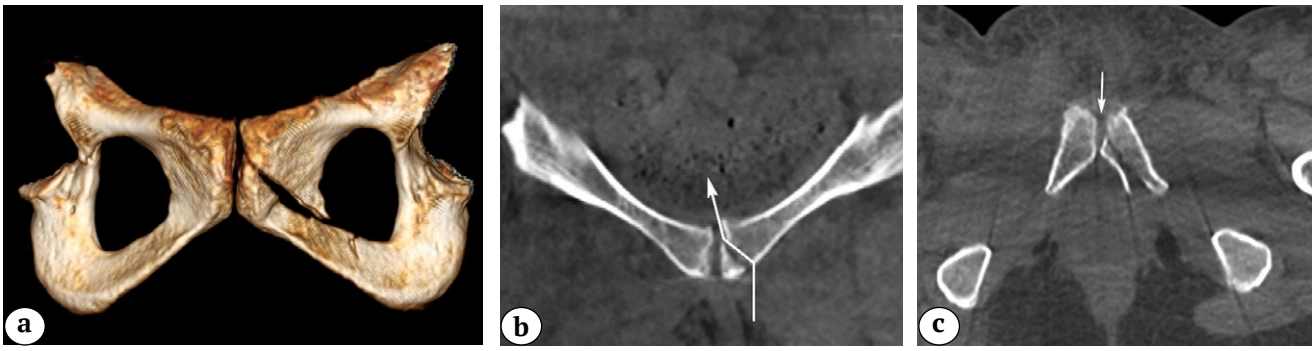


Fig. 4. Longitudinal fracture of the base of the pubic bone with a sharp ending:
a — 3D-CT image reconstruction, the arrow indicates the sharp end of bone fragment;
b — 2D-CT image reconstruction in the axial view, the arrows indicate the direction of the fracture along the base of the pubic bone



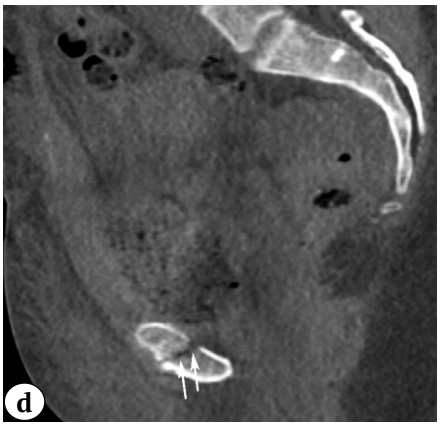


Fig. 5. Incomplete symphysis rupture with horizontal fracture of the pubic bone base:
a — 3D-CT image reconstruction;
b — 2D-CT image of incomplete symphysis rupture and the direction of the traumatic force;
c — 2D-CT reconstruction, the arrow indicates symphysis gap widening;
d — 2D-CT image reconstruction in the sagittal view of the pelvis, the arrows indicate the fracture line extending into the symphysis

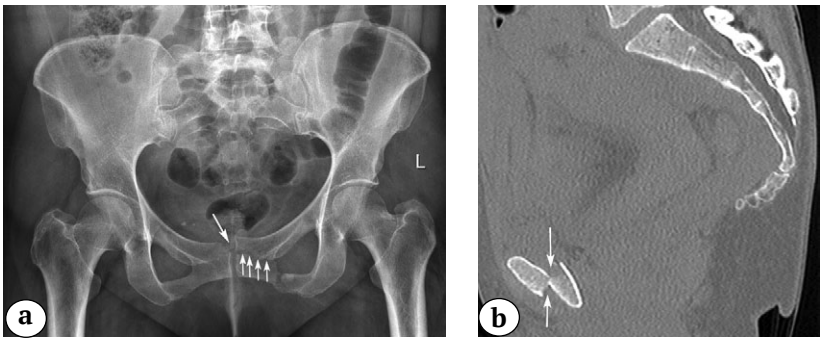


Fig. 6. Pelvis X-ray in the AP view. The arrows indicate the rupture of the superior ligament of the symphysis and partial widening of the symphysis, horizontal fracture of the base of the pubic bone (a); 2D-CT image reconstruction of the pelvis in the sagittal view. The arrows mark the displacement of the fragments (b)

2. Surgical anatomy of the posterior part of the ilium

The concept of "injuries to the posterior part of the iliac bone" includes a wide range of injuries, from sacroiliac joint disruptions to intra-articular fractures of the wing extending into the sacroiliac region (such as crescent fractures, etc.). Additionally, this area has become of interest in a surgical context due to the insertion of sharp-pointed pins for the Ganz anti-shock frame, cannulated screws during sacrum osteosynthesis, and the application of plate fixation. In surgical guidelines for acetabular surgery, this area lacks a specific name. Given that this area serves as an important anatomical link between the columns of the acetabulum and the axial skeleton, it makes sense to introduce an anatomofunctional name for it. We propose using the term "base of the Ilium" for this area with a definition of its approximate boundaries.

The base of the ilium

The base of the ilium — it is the entire area of the posterior part of the ilium to a hypothetical line drawn along the margin of the greater sciatic notch with complete involvement of the sacroiliac joint (Fig. 7).

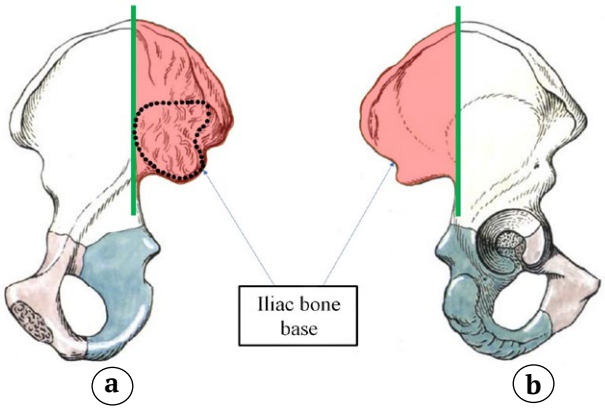


Fig. 7. Conditional localization of the iliac bone base (highlighted in red):
a — internal view, the dotted line indicates the articular surface of the sacroiliac joint;
b — outside view

Injuries to the base of the ilium

A typical injury resulting from lateral compression, which involves the sacroiliac joint, is the crescent fracture. The fracture line runs through the base of the ilium, penetrating the sacroiliac joint space, tearing the anterior sacroiliac ligament, and/or crushing the ala of the sacrum. On X-ray, you can observe the widening of the sacroiliac joint space. Such injuries are classified as AO/OTA type 61 B2.2 or LC-II according to Young-Burgess.

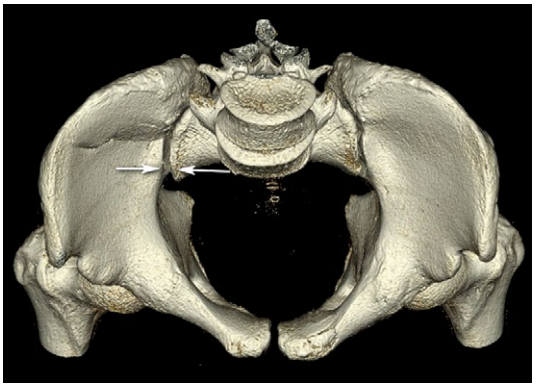


Fig. 8. 3D-CT image reconstruction of the pelvis, the inlet view. The arrows indicate the opening of the SIJ gap less than 1 cm

The crescent fracture forms a fragment of the posterior part of the ilium of varying size, which remains attached to the posterior sacroiliac ligaments, while the anterior ilium segment shifts relative to the sacrum. The smaller the crescent fragment, the more significant the area of the sacroiliac joint surface that remains on the anterior fragment of the ilium. Depending on the extent to which the fracture line penetrates the sacroiliac joint, these injuries are divided into three types according to the classification of A. Day [1]. The choice of treatment for a crescent fracture depends on the size of the joint surface that remains on the anterior fragment of the ilium [4].

The drawback of such an approach is the absence of a commonly accepted Russian equivalent for the term “crescent fracture,” and it doesn’t take into account the degree of displacement of the fragments (subluxation, dislocation). In such situations, we suggest using the phrase “fracture-subluxation” or “dislocation of the ilium base” and specifying the degree of displacement of the ilium base fragment. For example, if there is a fracture with a displacement of less than 1 cm in the sacroiliac joint area, the injury can be described as a “fracture-subluxation of the ilium base” of type II (according to A. Day’s classification) (Fig. 8).

In another case, when there is a fracture with a displacement of more than 1 cm in the sacroiliac joint area, the injury can be described as a “fracture-dislocation of the ilium base” type II according to A. Day’s classification (Fig. 9).

However, when analyzing fractures in the area of the ilium base, we have encountered fractures that do not fit into existing classifications. For example, fractures that run along the entire base of the ilium without penetrating the sacroiliac joint. For such fractures, we propose our own term — “longitudinal fracture of the ilium base” (Fig. 10).

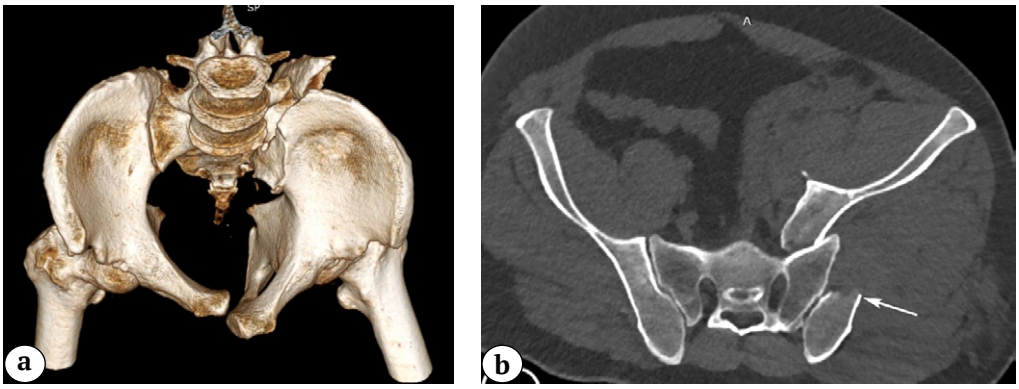


Fig. 9. 3D-CT image reconstruction of the pelvis in the inlet view (a); 2D-CT image reconstruction of the pelvis in the axial view. Displacement of the fragments in the SIJ is greater than 1 cm. The arrow shows the level of the fracture of the iliac base in relation to the CPS, type II according to A. Day (b)

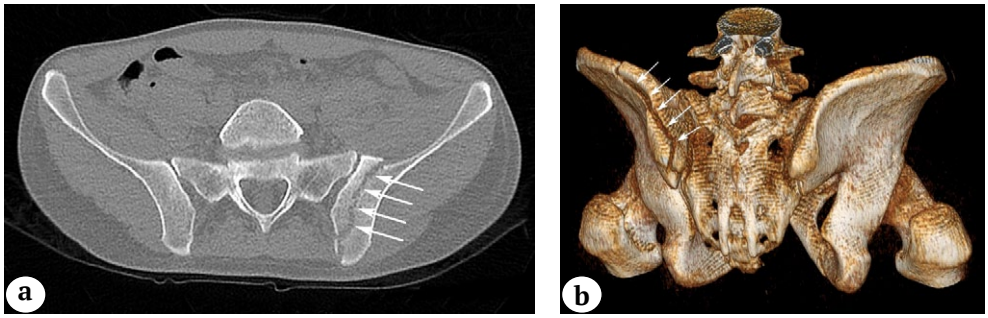


Fig. 10. Longitudinal fracture of the base of the iliac bone:
a — 2D-CT image reconstruction in the axial view; b — 3D-CT image reconstruction in the posterior view

Thus, based on our observations, we propose the following classification of injuries in this area, which is based on the degree of displacement of the fragments and is supplemented by the classification of A. Day.

Classification of the injuries to the iliac bone base:

– fracture-subluxation of the iliac bone base (displacement of the fragments less than 1 cm) + type according to the A. Day classification;

– fracture-dislocation of the iliac bone base (displacement of the fragments greater than 1 cm) + type according to the A. Day classification;

– longitudinal fracture of the iliac bone base.

Calcar

The founder of acetabular surgery, E. Letournel, developed a classification for its fractures based on the two-column concept [14, 15]. The area of dense cancellous bone that participates in transferring axial loads from both columns of the acetabulum to the sacrum is referred to as the “sciatic buttress” (Fig. 11).

It represents the area of the inferior posterior part of the iliac bone with the densest cancellous bone tissue, originating at the sacroiliac joint and extending further towards the acetabulum, forming the dome or arch of the greater sciatic notch. If, due to injury, there is a loss of connection between one of the columns and the axial skeleton through this bone region, it can be classified as either an anterior or posterior column fracture. In cases where both columnar connections to the axial skeleton are lost, it should be considered a two-column fracture of the acetabulum.

In the absence of a direct Russian equivalent in domestic literature, the term counterfort would be conceptually close, although it is primarily used in the context of describing cranial bones, such as the frontal-nasal or zygomatic counterfort [16]. However, an equivalent term with a similar meaning that has been used in trauma literature is calcar (for example, “calcar of the femoral neck” or “calcar of the shoulder). Given that this structure is located in the inferior part of the iliac bone, we propose the following term for its designation: “calcar of the iliac base”.

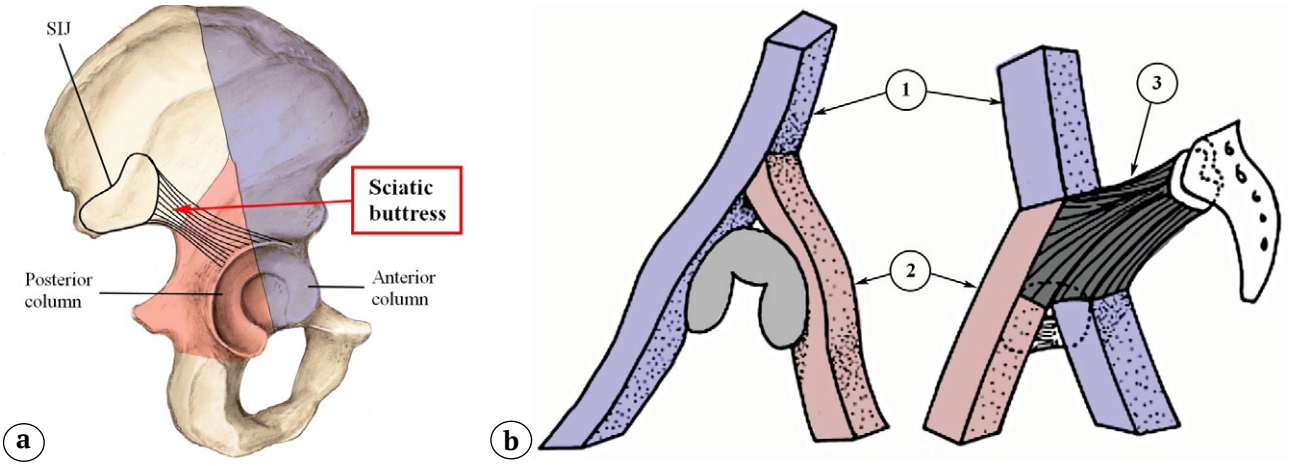


Fig. 11. Conditional localization of the sciatic buttress in the posterior iliac bone according to E. Letournel: a — outside view; b — scheme of the two-column concept of the acetabulum according to E. Letournel: 1 — anterior column, 2 — posterior column, 3 — sciatic buttress

Calcar spike

In the practice of traumatologists, there are some cases of transrectal fractures of the acetabulum with the extension of the fracture line into the calcar region, forming a characteristic sharp end called a "calcar spike."

The morphology of such a fracture is determined by the orientation of the bone trabeculae in this area (see Figure 12). A similar phenomenon can be observed in nature — wood always splits along its fibers. Similarly, in the case of pelvic fractures, the fracture line extends from the acetabulum to the calcar, splitting it along the bone trabeculae, resulting in the formation of a sharp end (calcar spike) (Fig. 13).

The calcar spike is an important diagnostic sign. It is a pathognomonic feature of high (transtectal or juxtatectal) fractures of the posterior column or transtectal fractures of the acetabulum, which require surgical treatment to restore joint congruence.

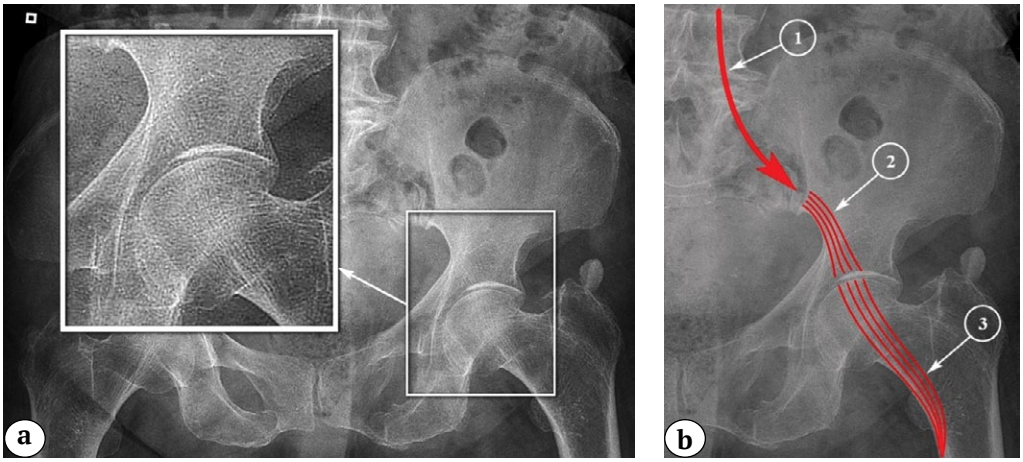


Fig. 12. Shaping of bone trabeculae along force loads through the femoral neck and femoral head on the iliac calcar (a); distribution of loads on bone trabeculae along the vertebral column, iliac base calcar, and hip (b). 1 — vertebral column, 2 — iliac base calcar, 3 — femoral neck

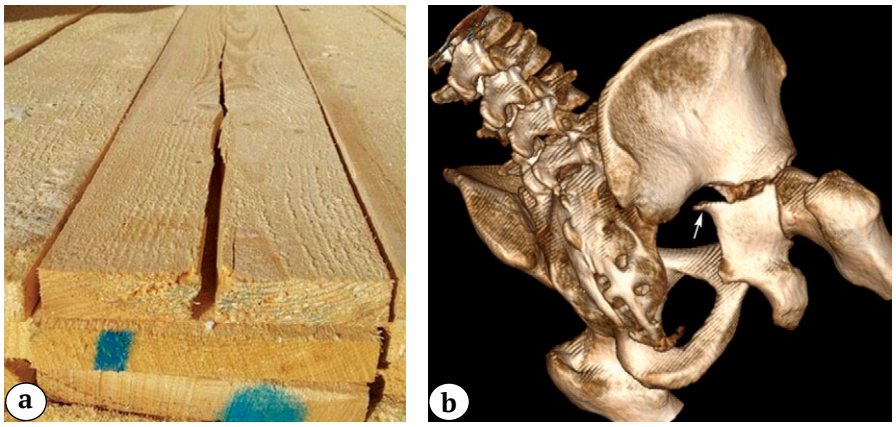


Fig. 13. Splitting of wood along fibers (a); splitting of the iliac bone along calcar trabeculae with formation of a sharp calcar spike (b)

The clinical interest in this situation primarily arises from the intimate proximity of the relatively large superior gluteal artery and the sciatic nerve to the sharp end of the posterior column fracture (Fig. 14a). The artery and nerve can be damaged both directly during the trauma and iatrogenically when attempting to expose them during open reduction of the fracture. Intraoperative bleeding from the superior gluteal artery can pose an existential threat to the patient and requires careful preoperative preparation. Damage to the sciatic nerve can lead to neurological deficits, potentially resulting in impaired lower limb support function and significant pain syndrome.

In our opinion, when a calcar spike is present, it is advisable to perform a pelvic CT scan with contrast to visualize the vessels of the internal iliac artery and rule out damage to the superior gluteal artery. If the artery is already damaged or is at a safe distance from the spike's tip, open reduction can be performed using the conventional technique.

In cases where the calcar spike is in close proximity to the preserved superior gluteal artery, we recommend performing an osteotomy of a sharp end of spike that is in contact with the vessel (Fig. 14b). This approach significantly reduces the risk of damaging the artery during its dissection and repositioning maneuvers with the remaining fragment of the posterior column.

For surgeons with sufficient experience and specialized instruments, it is possible to carefully dissect the calcar spike from soft tissues and perform open reduction using the "palisade technique" with the use of J. Matta's forceps [17]. Thanks to the high bone density in the calcar region, the fragment does not split even under substantial repositioning forces (Fig. 15).

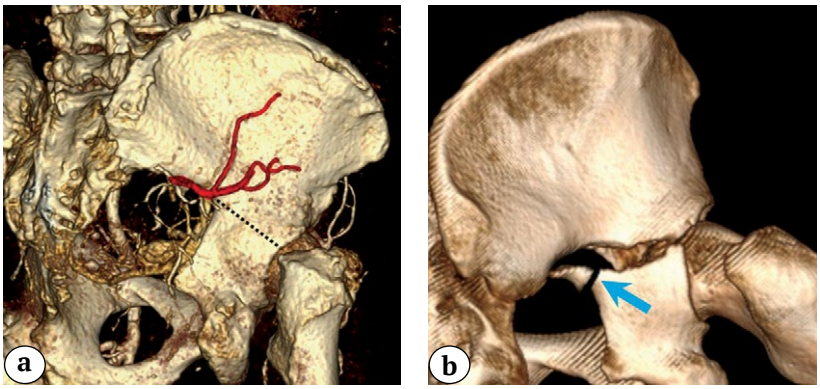


Fig. 14. Superior gluteal artery (a); osteotomy of the calcar spike, the arrow marks the level of osteotomy (b)

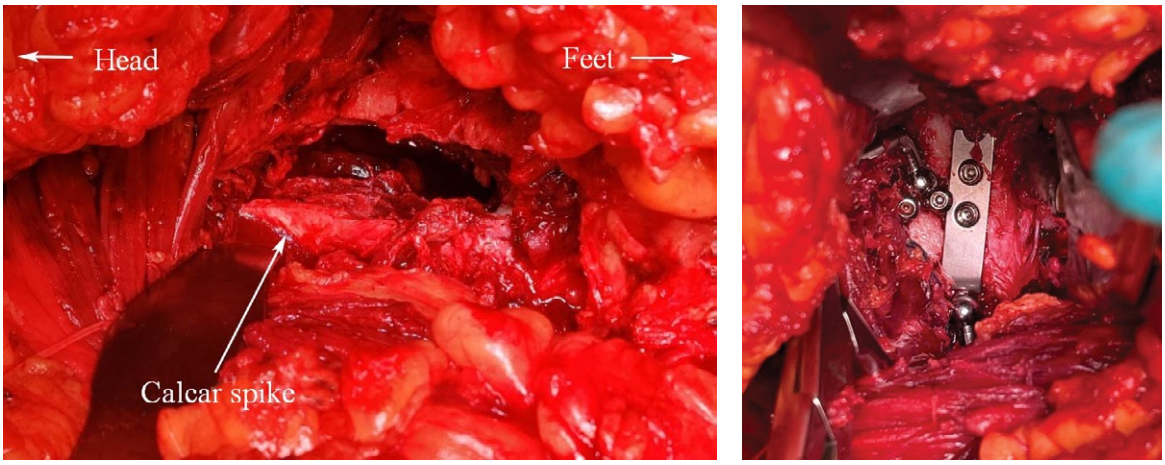


Fig. 15. Open reduction of the calcar spike with Matta clamp and plate fixation

3. Intraosseous canals

With the advent of the method of fixation of long bone fractures with interlocking nails, assessment of the anatomy of the intraosseous canal (its size, localization of narrowing (isthmus), etc.) has become an important parameter for the correct choice of fixator and successful intramedullary osteosynthesis. The intraosseous canal of long bones is a natural anatomical cavity that is limited by a diaphyseal bone tube filled with bone marrow or fat and is called the "medullary canal". The isthmus is the narrowest part of the bone canal. The inner surface of the isthmus of tubular bones can be visualized in the form of an "hourglass" (a single-cavity hyperboloid).

In pelvic fracture surgery, intramedullary fixators such as screws and intramedullary nails are also used. However, unlike long bones, flat bones of the pelvis lack natural canals, and they primarily consist of cancellous tissue surrounded by a thin cortical layer. Nevertheless, specific areas within these flat bones can be identified for the placement of appropriate fixators [18].

To denote the bone canal in the flat bones of the pelvis for the subsequent placement of a fixator, we propose using the term «bone corridor» (Fig. 16). The bone corridor is a virtual space within the flat bone that allows the safe placement of a fixator. It comprises various possible positions (trajectories) for the fixator's placement without breaching the cortical layer.

The shape of the bone corridor depends on the type of fixator. For example, in the case of a straight screw, the bone corridor appears cylindrical, with its maximum diameter matching the narrowest point within the bone along its placement. In the case of a curved fixator, the bone corridor typically has a broader but more complex geometry. It takes on a triangular shape with a complex curved convex surface,

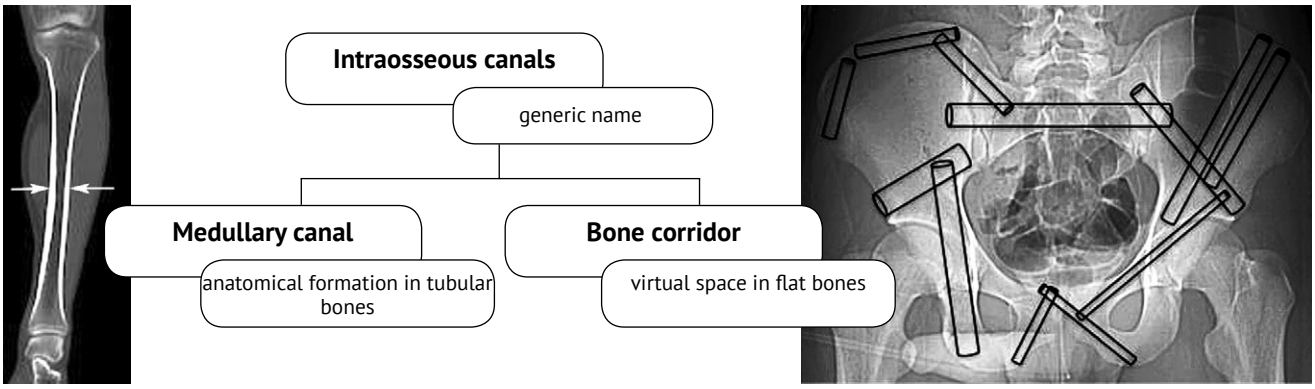


Fig. 16. A set of terms to define medullary and intraosseus canals in tubular and flat bones

with its vertex located at the point where the fixator is introduced. The curvature follows the curve of the linea terminalis, and the convexity corresponds to the curvature of the acetabular dome. The thickness of such a corridor matches the narrowest part of the bone (the isthmus) where it is located (Fig. 17).

Isthmuses in pelvic bones, unlike long bones, are typically irregularly shaped slit-like spaces located between the nearest cortical plates.

Consequently, this allows for the use of larger-diameter curved implants (nails) in contrast to straight ones (screws, nails). In most cases, this provides an advantage in fixation stability.

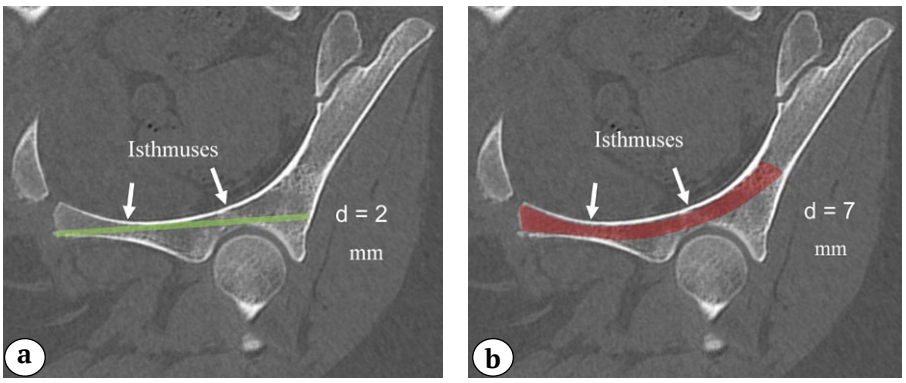


Fig. 17. CT scan of the pelvis in the axial view at the level of the acetabulum:
a — bone corridor for a straight fixator with a diameter of 2 mm;
b — bone corridor for a curved fixator with a diameter of 7 mm

CONCLUSIONS

This study has led to the development and presentation of new anatomical terms designed for use in pelvic surgery. Based on the data analysis, their importance and applicability for improving communication and information exchange in this complex field of surgery have been affirmed.

According to S. D. Denisov and colleagues, «For the successful implementation of a unified anatomical terminology, it is not enough to simply develop, approve, and publish it. There should also be motivation for its widespread use. Terminological discipline should have organizational and administrative support from both government organizations and professional associations» [19]. Psychological acceptance of the need to transition to new terminology by specialists is also important because «criticism of outdated or irrelevant terms can provoke protest and be seen as an attack on tradition» [20].

The implementation of new anatomical terms into clinical practice will significantly improve the accuracy of diagnosis, planning, and execution of surgical interventions for severe pelvic injuries. Standardizing the terminology will help systematize treatment approaches and facilitate the exchange of experiences among medical specialists, ultimately enhancing the quality of surgical care for patients with pelvic bone fractures.

Key findings from the conducted research are as follows:

– the bodies of the pelvic bones form joints (the acetabulum);

– the bases of the pelvic bones form articulations (the pubic symphysis, sacroiliac joint);

– calcar is the densest area of the ilium base, responsible for transmitting loads from the sacrum to the acetabulum and vice versa;

– calcar spike is a typical fracture of the ilium base in the area of the calcar with the formation of a pointed fragment;

– in flat pelvic bones, the concept of the «bone corridor» should be emphasized, which is a species notion related to the term «intramedullary canal» and essentially represents a virtual space with geometry dependent on the implant's shape.

DISCLAIMERS

Author contribution

Zadneprovskiy N.N. — study concept and design, data analysis and interpretation, literature search and analysis, writing the article.

Kulikov V.V. — literature search and analysis, drafting the article.

Vladimirova Ya.B. — literature search and analysis, drafting the article.

Ivanov P.A. — data analysis and interpretation, drafting the article.

All authors have read and approved the final version of the manuscript of the article. All authors agree to bear responsibility for all aspects of the study to ensure proper consideration and resolution of all possible issues related to the correctness and reliability of any part of the work.

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