SPINAL COLUMN INJURIES: FROM THE VERY BEGINNING*

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The history of medicine is interesting and instructive. In each of the many branches of medical science, the specificity of pathology determines diagnosis and treatment. These processes inevitably continue in time and space in accordance with the conditions existing in a given place and in a given period of time. Spine injury is one of the most striking examples of the longevity and duration of this process. Humanity relatively recently discovered what diabetes is and how it should be treated, but this branch of medicine also has its own history, although not a very long one. Spinal injuries have accompanied man and his predecessors almost always, disrupting the usual rhythm of life, and therefore they have been required to be treated since time immemorial. A true professional is always interested in the history of his specialty. Spine surgeons are no exception. What we managed to collect bit by bit, of course, is not everything, but it is impossible to grasp the immense, and it is necessary to know the past in order to better understand the present and the future.

Key Words: spine; injuries; vertebrology; spine surgery; history of medicine.

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Nicolaas Bidloo – personal physician of Peter the Great

Nicolaas Bidloo (1669–1735) was a Dutch doctor of medicine (Fig. 1), born in Amsterdam, who received his doctoral degree from the University of Leiden for his dissertation "De menstruorum suppression" ("On the delay of menstruation"). According to a contract signed with the Russian ambassador Matveev in 1702, he agreed to work in Moscow as Peter the Great's personal physician with an annual salary of 2,500 Dutch guilders. After several years being within call of Peter, who was notable for his good health in those years, he told Peter in a conversation that he asked to send him home as stay in Moscow was no reasonable any longer. Rather than resign, he was asked to design a hospital or medical school in Moscow. According to Bidloo's project, a hospital (now the Burdenko Main Military Clinical Hospital) and Russia's first Hospital School of Medicine and Surgery for 50 students were opened in Moscow in 1707 (Fig. 2). For 30 years, Bidloo was its inspector and professor of anatomy and surgery. Bidloo's authority as a doctor was extremely high. Thus, five years after his death, his successor as a director of the hospital school and physician in ordinary, L.L. Blumentrost, without hesitation, recommended a certain captainess Engelbrecht to the court of Anna Ioannovna as a midwife just because she often assisted Dr. Bidloo in childbirth. N. Bidloo was married to Clasina Claes, and they had children, who remain unknown.

Nicolaas Bidloo left a number of guidelines, the most important of which is "Instruction for those studying surgery in the anatomical theatre". The fate of this book is curious in itself. It has been preserved only in manuscript form, in Latin, the only copy of which was kept in the Fundamental Library of the Military Medical Academy. It was translated into Russian and published in Moscow in 1979 (Fig. 3).

There are only two small sections in this comprehensive guideline on treatment strategies for spinal injuries. We present both of these sections in their full text.

On surgery for a fracture of the spinous process

"The manner in which a fracture of the spinous process of the vertebra occurs, its causes, the signs by which it is recognized – all this will not be explained here. Only the treatment or treatment technique should be considered.

1st: The fracture is recovered in its place.

2nd: Longitudinal compresses are applied to the back on both sides of the fractured vertebra to prevent the broken vertebra from dislocating in different directions.

3rd: Over these compresses, another longitudinal one is applied to fill the cavity formed between the two compresses mentioned above.

Some insist on applying patches like acetic and saffron, sudatory, Felix Wurtz's. Hence our Dr. Bidloo does not recommend [it] because the said patches are unsuitable and nondurable to cure and preserve the continuity of the part. The only patches [are applicable] that only warm and open the pores.

Compresses are always applied, being steeped in an appropriate liquid that is effective against complications and [for] the formation of calluses.

4th: The patient is bandaged with a dressing called a towel or Servetbant.

5th: A scapular dressing is placed on top to keep the towel from slipping off.

* *End. Beginning in No. 2, 2024. P. 90–102.*

Fig. 1
Nicolaas Bidloo

If [the fracture] occurred between the medial border of scapulas, two longitudinal compresses are applied. Over them, another compress is placed to slightly press down. On top of all of them another compress is put that fills the cavity between the medial border of scapulas, so that the dressing was even. Then the fracture site is tied crosswise with a simple dressing eight cubits long.

Vertebral dislocation

If the vertebra is dislocated outward, it is bandaged in the following manner.

1st: A person is laid on a board and extended with an instrument called a glossocomium.

2nd: One takes a long iron rod and places it on the dislocated vertebra. Two surgeons hold the rod at both ends and carefully and firmly apply even pressure to the vertebra.

3rd: A compress is applied to the corrected vertebra, supported by Servetbant or a towel. Then a scapular [dressing] must be placed on the upper part of the body to prevent the towel from slipping off.

If the dislocation is inward, the person is extended with the glossocomium. An incision is then made on both sides of the dislocated vertebra, above its oblique processes, up to the vertebra itself. It is then captured with non-sharp forceps and elevated. The patient must lie quietly and not move to prevent a recurrence of this suffering.

"Regarding these lectures, form your own opinions and draw your own conclusions."

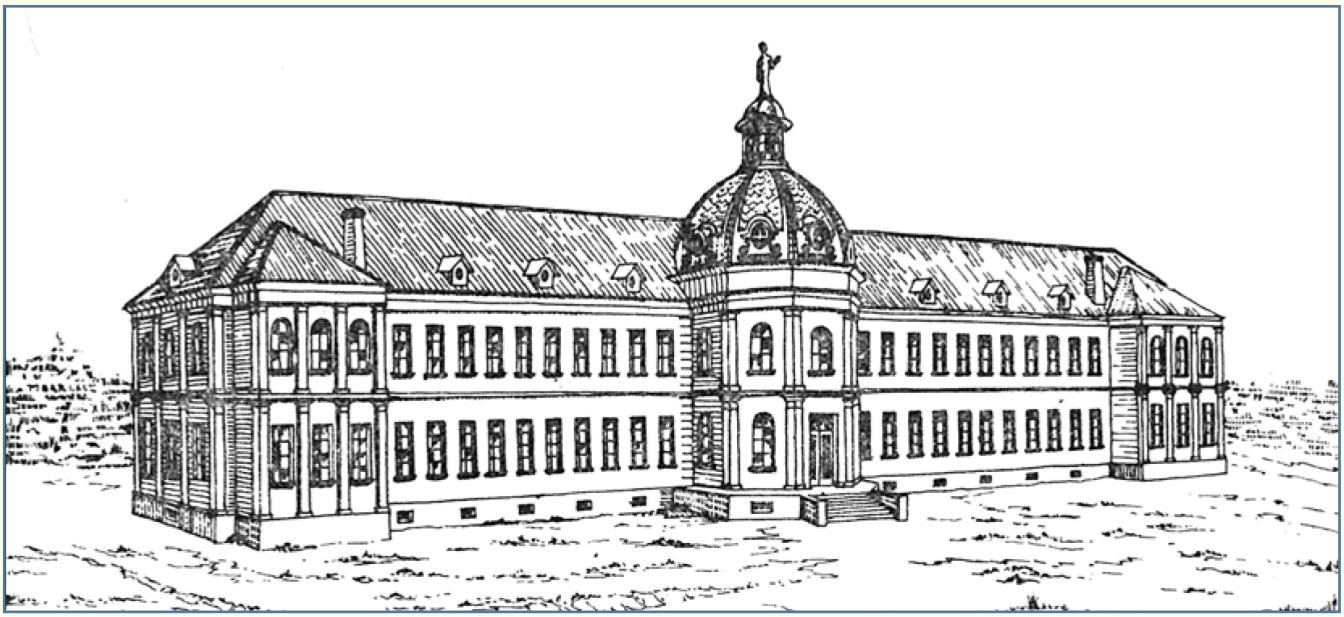

Fig. 2
Moscow Hospital, 1725–1737 [3]

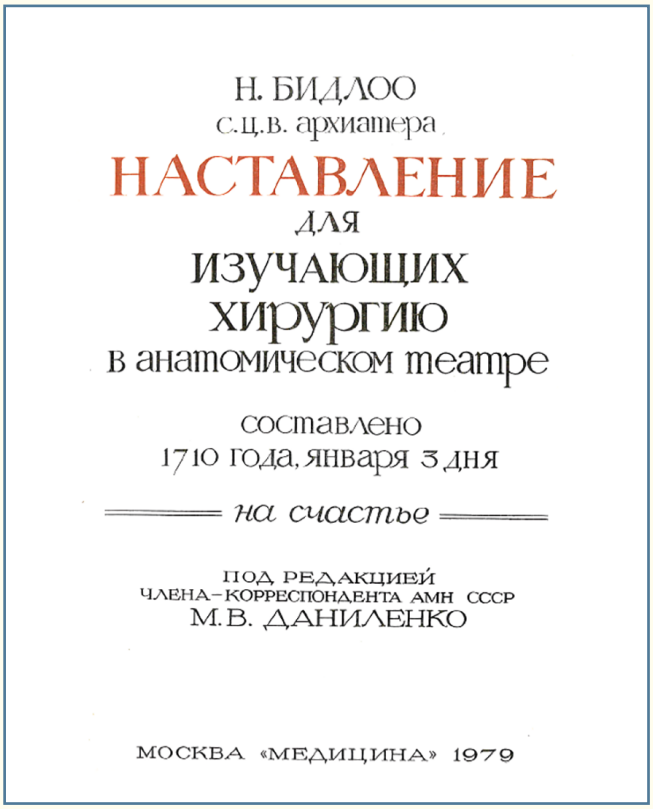

Fig. 3
Cover of the book by N. Bidloo [3]

Eduard Albert

Eduard Albert (1841–1900) was a Czech-Austrian surgeon and translator focusing on literature (Fig. 4). He was born in a family of watchmakers and attended school in Senftenberg. He studied medicine at the Josephinum in Vienna, including with the famous pathologist Carl von Rokitansky. In 1868, he married M. Peschova (1845–1924), the daughter of the physician, and they had a son and a daughter. In 1874 he became a professor at the clinic in Innsbruck, where he introduced compulsory antiseptic treatment of the wound. In 1881, professor Albert was succeeded by Carl Nicoladoni (1847–1902) and headed of the First Surgical Clinic in Vienna and remained in this capacity until his death. Since 1886, he has been a member of the Supreme Board of Health; since 1890, he has been a member of the Czech Academy of Science, Oral Speech, and Art, as well as of the Academy of Medicine and the Surgical Society in Paris. He was an honorary member of the Royal Society of Surgery in London, holder of the Knight's Cross and the Order of Leopold, and the personal physician of the Emperor Franz Josef I. He edited the specialized journals such as the Medical Yearbooks and the German Journal for Surgery. As a politician, he ran for the Reichsrat in 1879, but unsuccessfully. Albert died of a stroke in 1900; his grave is in Vienna Central Cemetery.

Albert published 177 papers, mostly in the field of surgery, and was one of the originators of antiseptics and theoretical orthopedics. He performed the first arthrodesis and also introduced this term into practice. Among his most famous students were Adolf Lorenz (1854–1946), the so-called "bloodless surgeon of Vienna", and Antonio Grossich (1849–1926), who in 1908 introduced the procedure of applying 10 % tincture of iodine to the surgical site (first for emergency surgeries, later for all types of surgery).

The most prominent publications of Prof. Albert are "Beitrage zur Geschichte der Chirurgie" (Vienna, 1878), "Lehrbuch der Chirurgie" (3 ed. in 4 volumes, Vienna, 1884–1885), and "Diagnostik der chirurg. Krankheiten in 20 Vorlesungen" (3 ed., Vienna, 1885).

Besides his professional activities as a scholar and physician, he devoted himself to Czech literature as a critic, poet, and translator. As a patron of the arts, he promoted Czech politicians and artists and also corresponded with writers whose books he translated into German.

In the first volume of his guideline, translated into Russian and published in St Petersburg in 1902, he included sections on disorders of the face, neck, vertebral column, thorax, and upper

Fig. 4
Eduard Albert

extremity. Beginning with a description of the anatomy and function of the spine, he considered it necessary to emphasize that the physiology and movement patterns of the joints of the spine were not well understood. *"Currently, however, we have no such study; for this reason, we do not know in detail for what phases of the certain movements the ligamentous apparatus and the articular mechanism of the processes serve as an obstacle; it is not yet proven whether the joints have any effect at all on the movements of the vertebral column in toto."* The only known information is the range of movements of the vertebral column. He refers to an experimental study by H. Meyer (year not specified), who dissected a corpse in the sagittal plane from the head to the pelvis and laid it on a board with the cut side down, while the sacrum and pubic bone were nailed to it. Then, the spinal column was placed in various positions in the sagittal plane and marked on the board with a pencil. Thus, it was possible to determine the range of movements in the cervical and lumbar spine quite accurately.

Albert distinguishes fractures of vertebral bodies, arches, transverse, and spinous processes. The following types of injuries were distinguished according to their form:

a) cracks and breaks;

b) compression (first described by Middeldorpf): the substance of the vertebral body is compressed, and its height in front is reduced (Fig. 5);

c) displaced fractures: either individual fragments or the entire vertebra are displaced ("dislocation fracture"). In fractures of the vertebral bodies, the upper smaller fragment "slides" over the lower one, dropping downwards and to the front, resulting in a "bend" of the vertebral column, narrowing of the spinal canal and compression of the spinal cord (Fig. 6).

"Spinal cord injuries are of various degrees: the spinal cord may be split completely across, or may be crushed, swollen, present a red softening, or appear flattened, twisted, or depressed in a known place, or spitted." That was how Albert describes the changes observed at the autopsy or during the laminectomy.

He highlights that the diagnosis of spinal fractures *"is sometimes associated with tremendous challenges."* This is not surprising, as the great discovery of Wilhelm Conrad Rontgen dates back to 1895, and its achievements had not yet become widespread at that time. "In fact, a fracture can be recognized only by abnormal mobility of the bone along its extent." Indirectly, a fracture can be determined by deformity (probably the author is referring to the spinous process line) or by the presence of bony crepitus. Finally, all the circumstances of the injury must be considered. E. Albert provided a very detailed description of the course of spinal injuries at various levels, relating it to the corresponding neurological symptoms that can complicate the injury of bone and ligamentous structures. E. Albert believed that *"the fracture itself is very complicated to heal; the bone callus is one of the rarest phenomena. Either necrosis of the fragment with suppuration or ulceration of the joints ... with carious destruction of the surrounding parts often develops, causing patient's death".*

The author believes that treatment should begin with an attempt to "reposition the fragments" that is dangerous itself because of the risk of spinal cord compression, but "... by exerting only slight traction and gentle pressure on the displaced parts." E. Albert mentions that "recently" Dr. Konig has recommended plaster dressings in the hanging position (no details are given) and reports that Dr. Wagner and himself have used this technique with very mixed outcomes. Cases of spinal cord compression *"had early prompted the idea of surgical treatment to expose the displaced fragments and to elevate them."* The long history of the injury is not so significant. It is possible to achieve the goal, but not in all cases. The author does not provide any other details on the treatment of patients with vertebral body fractures.

Regarding vertebral dislocations, the ideas of more than a century ago about their types and mechanisms of manifestations are not very different from those of today. This is confirmed by the illustrations in E. Albert's book that, apparently, were made from spine specimens since there was no radiograph: "bilateral dislocation posteriorly" (Fig. 7), "bilateral-opposite dislocation" (Fig. 8), "unilateral dislocation anteriorly – posterior view" (Fig. 9), and "simple incomplete dislocation anteriorly" (Fig. 10). Nowadays these injuries have different names, but an experienced traumatologist will have no difficulties in identifying them. The author further emphasizes that *"...considering to the rare occurrence of certain forms of dislocation, a definitive symptomatology is out of the question".* Nonetheless, he describes in details the clinical manifestations of bilateral anterior and unilateral dislocations of the cervical vertebrae. Regarding the repositioning of a dislocated vertebra, E. Albert believes that it is absolutely essential, and as early as

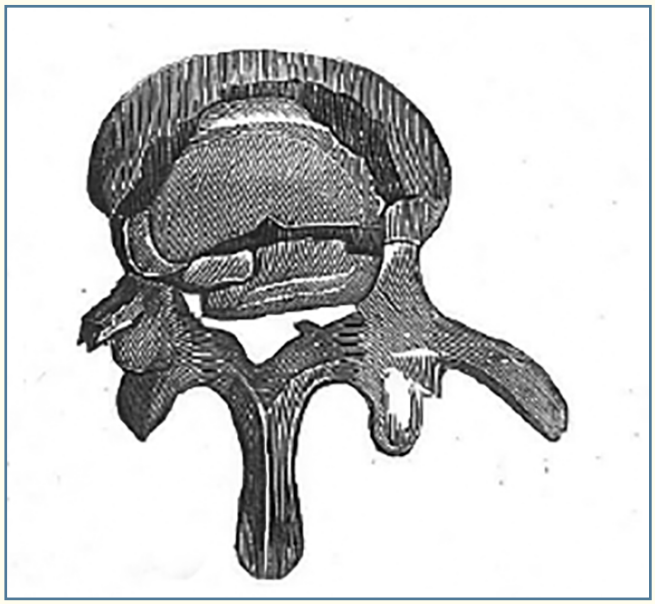

Fig. 5
Vertebral body fracture with compression [1]

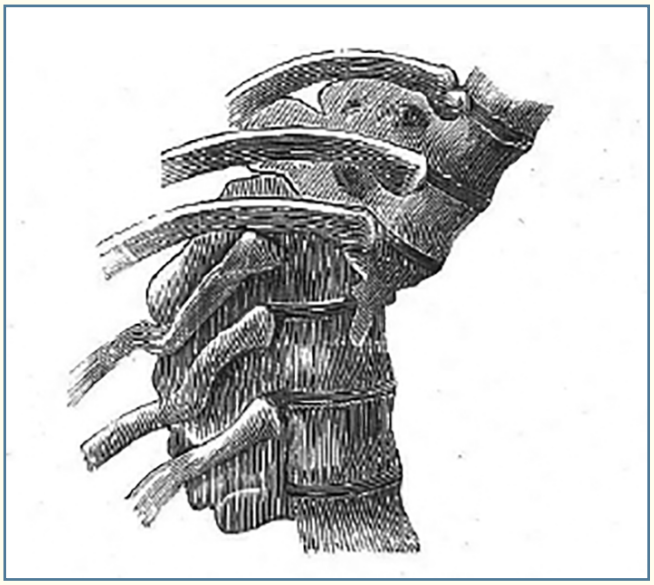

Fig. 6
Vertebral body fracture with dislocation [1]

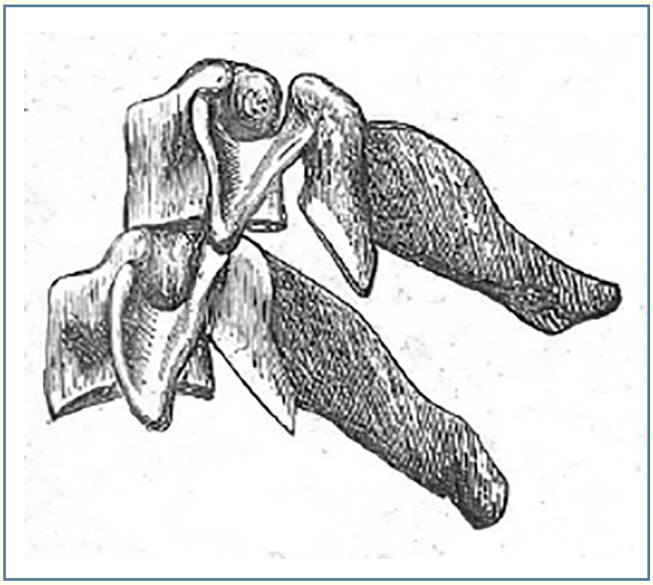

Fig. 7
Bilateral dislocation posteriorly of a cervical vertebra [1]

possible. At the same time, he emphasizes that *"formerly"* it was considered dangerous. The repositioning technique described by E. Albert has not changed to date. We often use the name Hueter, but E. Albert mentions it only once in reference to the necessity in bilateral dislocations to perform repositioning on each side separately.

According to autopsy data, thoracic spine dislocations are quite real, and they can include anterior, posterior, and even lateral dislocations. The mechanism of their development is not entirely clear, but a considerable amount of force is definitely required. Reduction is performed in the traditional manner: axial traction and pressure "on the extruded vertebra". Lumbar vertebral dislocations are also rare but real; anterior dislocation is more common.

Lorenz Böhler

Lorenz Böhler (1885–1973) was an extraordinary Austrian surgeon. He was born in the family of ordinary craftsmen, but from his early childhood he dreamed of becoming a doctor (Fig. 11). On December 6, 1896, when a radiological image of Wilhelm Röntgen's wife's hand was published in "Das Interessante Blatt," little Lorenz cut out the figure and pasted it into his textbook. After finishing school, he entered the Faculty of Medicine at the University of Vienna. In 1910, he married a nurse from the Bregenz Hospital, where he undertook his internship at the time. In July 1911, he received his MD degree and then for some time worked in the clinic of his teacher, Prof. Julius Hochenegg, who was one of the first to open an emergency surgery unit. In 1914, Böhler travelled to an international surgical congress in New York and on the way met a Belgian, Albin Lambotte, who told him about

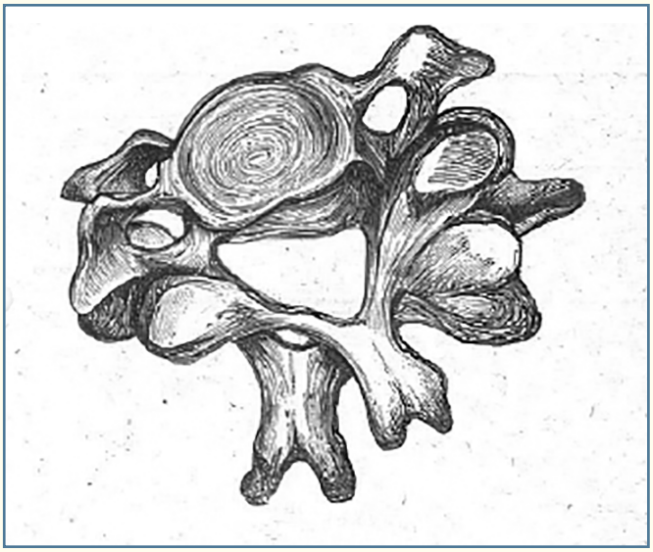

Fig. 8
Bilateral-opposite dislocation [1]

surgical techniques for the treatment of fractures. Later Böhler spent some time at the Clinic of Dr. Mayo (Minnesota), who described to him the functioning of traumatology clinics in London and Liverpool. At that time, there was nothing like this in Germany and Austria. Mayo gave Böhler a letter of reference for Dr. Arbuthnot Lane from London, one of Europe's leading specialists, but the visit was impossible due to the beginning of World War I. Böhler was drafted into the army, and from 1914 to 1916 he worked as a surgeon at the Divisional Hospital No. 8 of the Tyrolean Royal Huntsmen,

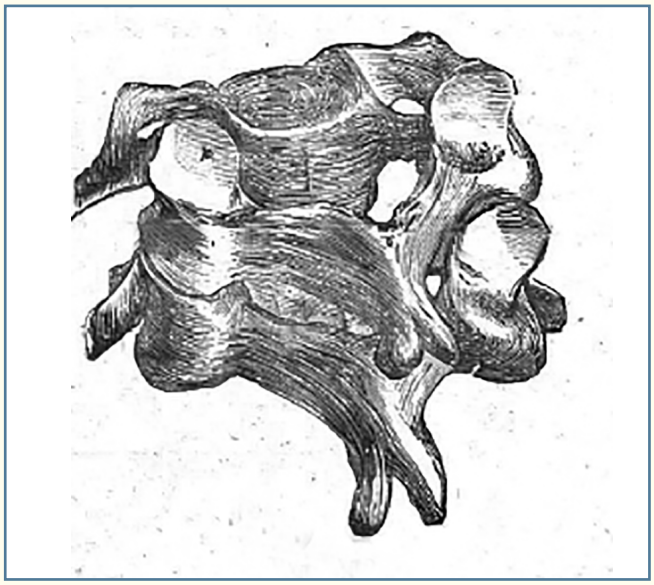

Fig. 9
Unilateral dislocation anteriorly, posterior view [1]

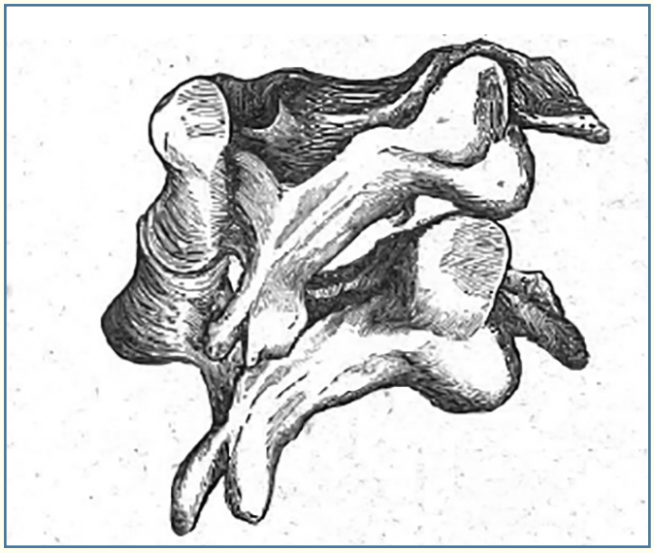

Fig. 10
Simple incomplete dislocation anteriorly [1]

where he became a leading specialist. At first, he was not authorized to treat soldiers with gunshot fractures, but as he proved his skill as a doctor, he was granted permission, and the hospital became a specialized one. Here Lorenz Böhler implemented his basic ideas: specialization and standardization; documentation for statistical analysis (basic information is recorded on a plaster dressing); gradation of patients according to the severity of the injury; lightly wounded patients were used to work in the hospital. This helped to prevent the chaos that prevailed in other hospitals,

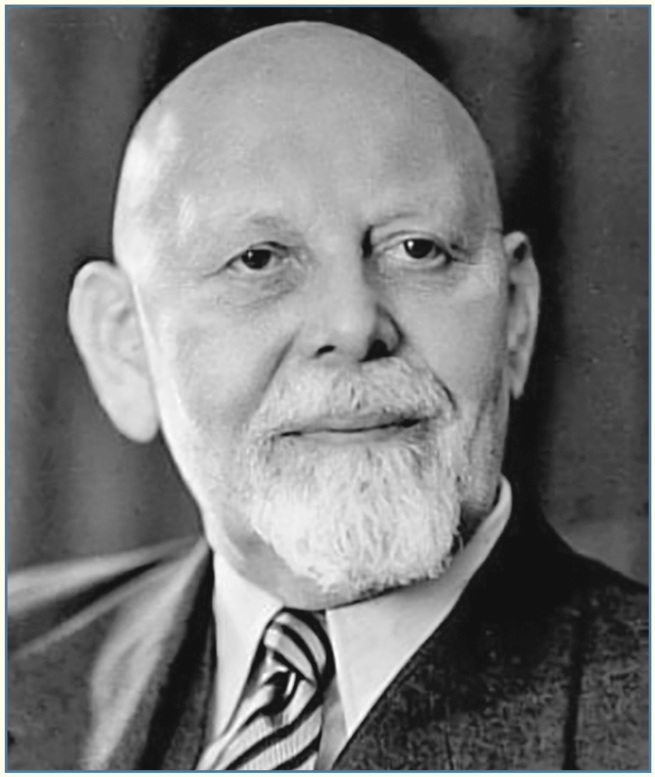

Fig. 11
Lorenz Böhler

where the wounded were crowded together. In 1918, Böhler was briefly imprisoned in Italy, where he also worked as a doctor.

Returning to Vienna, Böhler tried to establish a network of specialized traumatology units, and in 1925 he succeeded in opening a specialized hospital (AUVA-hospital), which was run by himself. His career grew, but not all Viennese colleagues accepted his ideas. In 1930 he was appointed professor at the University of Vienna, where he taught emergency medicine. In 1936 he was promoted to associate professor and in 1954 to professor.

Not much is known about his life during World War II. In 1938, he became a member of the Nazi Party. In the summer of 1939 along with 12 professors and lecturers of Vienna's University he signed a letter claiming that *"...we, the undersigned, know of not one case of persecution of a professor for his racial or religious adherence. ... It could rather be said that by the removal of certain influences a trend of charlatanism, which was beginning to damage the reputation of the Vienna medical clinics in the eyes of serious medical men, was eliminated"*.

As much as anything else, Lorenz Böhler worked at the Rudolfspital in Vienna, where he headed a specialized fracture hospital. His son Jorg Böhler ran the AUVA-hospital from 1970 to 1983.

Böhler was a member of 33 scientific associations in different countries, and a hospital and a street in Vienna are named after him. The main publication of his life was the treatment guideline

"Treatment of Fractures". Originally published in 1929, it has been reprinted many times, growing from 176 to 2,500 pages, and has been translated into eight languages, including Russian.

The fundamental principles of fracture treatment according to Böhler are as follows: to save life, to save extremity, and to preserve function. For this purpose: early diagnosis, early repositioning, immobilization, active pain-free movements in uninjured joints.

Böhler describes his experience in the treatment of spinal injuries, starting with cervical spine injuries. Flexion injuries require traction with a Glisson loop in a position of slight extension (Fig. 12), while extension injuries require a position of flexion achieved by placing pads at the required level. Since injured patients may find it uncomfortable to lie in this position, a plaster half-jacket (Fig. 13) is applied after 2–3 days for 8–10 weeks. In the case of slight fractures (Böhler does not specify what is meant), a cotton collar can be used for 6 weeks.

Describing in detail the mechanism of fractures of the thoracic and lumbar vertebrae and the pathological anatomy of these injuries, Böhler highlights that *"...the task of treatment consists in repositioning the fragments as accurately as possible and keeping them in the correct position until they become fused with each other by ossification (remember that Albert practically excluded such a possibility), and at the same time it is important to provide for active movements of individual parts and the whole body"*.

Böhler considered it necessary to differentiate the solution to this problem. For example, for non-displaced fractures, he prescribed bed rest for a period of two to five weeks, but over time he found it appropriate to change his strategy. He concluded that *"...even in these relatively slight fractures, the spine should be hyperextended and a plaster jacket should be applied immediately in this position"*. If *"...the cast fits well, the patient immediately stops feeling pain and can walk and work. This prevents atrophy of muscles and bones"*.

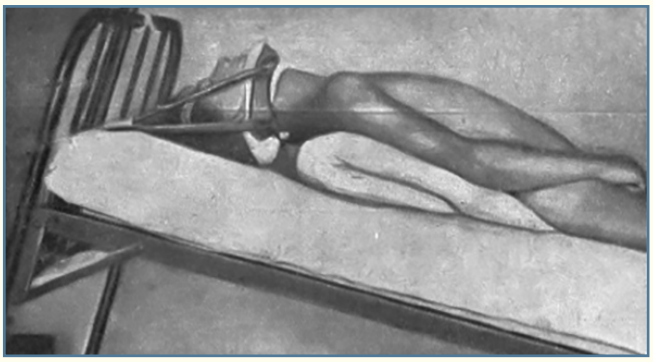

Fig. 12
Fracture dislocation of the C5 vertebra. A hard hair pillow is placed under the patient's shoulders, the head of the bed is raised by 50 cm. This achieves extension of the cervical spine and longitudinal traction [2]

Böhler used Davis reposition for displaced fractures for a while and later the Watson-Jones approach with hyperextension of the spine on different-height tables. Its application became much easier when Schneck (1930) developed a technique of local anesthesia for these injuries (Fig. 14). After effective anesthesia and proper patient positioning, thoracic spine extension and restoration of normal lumbar lordosis can be achieved within 10–20 minutes. The application of a plaster jacket is a very challenging procedure, and Böhler has paid particular attention to describing it. He reported in detail all the procedures to obtain a strong plaster jacket with three main points of support: the upper part of the sternum and pubis anteriorly and the apex of the lumbar lordosis posteriorly. A "window" is formed in the area of the anterior abdominal wall. The cast must be properly marked by putting the following information on the cast: the date of injury, reposition, the upcoming removal of the cast, and the radiological pattern (Figs. 15, 16). The duration of immobilization depends on the severity of the injury and is about 8–12 weeks. Remedial gymnastics shall be started immediately (Fig. 17), and exercises shall be performed 2–4 times a day. These include, among other things, carrying sandbags weighing up to 40 kg on the head (Fig. 18). The effect of these exercises is to strengthen the abdominal muscles 5 weeks after repositioning to such an extent that they can support the weight of the patient (up to 65 kg), the cast (8 kg), and the sandbag (35 kg) – up to a total of 108 kg (Fig. 19).

In complicated spinal fractures, it is important to ensure reposition as soon as possible. It is emphasized that reposition under local anesthesia by traction alone, i.e., without any

Fig. 13
On the left is a plaster half-jacket for the treatment of severe fractures and dislocations of the cervical spine, on the right is a cervical cotton collar according to Shantz for fixing the cervical spine [2]

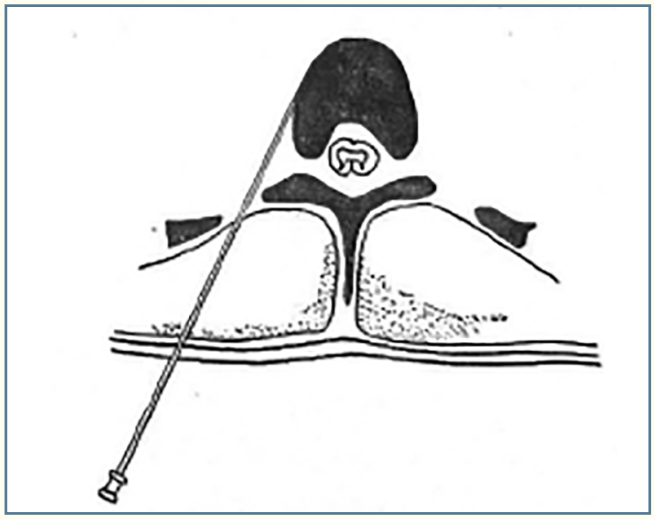

Fig. 14
Technique of anesthesia of a fractured vertebral body according to Schneck [2]

pressure at the level of the injury, restores the normal lumen of the spinal canal and intervertebral foramen. If paralysis is present, a plaster jacket is contraindicated because of extremely prone to the formation of bedsores. After repositioning, it is better to place the patient in a plaster bed and perform prolonged traction. Regarding surgical treatment, acute fractures accompanied by paralysis should never be operated on if it is possible to achieve repositioning by traction. For fractured dislocations without fracture of the articular processes, surgery must be performed on the first day, assuming that traction has not resulted in reposition and the status of the patient is suitable. Using intraoperative traction and resection of the spinous and articular processes, complete vertebral reposition can be achieved. *"In the case of an incomplete rupture of the spinal cord, the paralysis resolves over time, sometimes immediately after the surgery"*. Böhler reports that he has never noted any cases of isolated fractures of the vertebral arches with spinal cord compression, which were described in the literature of those years as an indication for surgery. Late laminectomy provides very poor outcomes.

Watson-Jones

Sir Reginald Watson-Jones (1902–1972) was a prominent English orthopedic surgeon. He was born in the family of Edward Henry Jones, a senior officer working for Dr. Barnado's Homes, and his wife Alice, née Watson.

After contracting typhoid in his youth, the younger Jones decided on a career in medicine and set his heart on orthopedic surgery after he underwent a surgery for hemangioma removal. He joined the Medical School of Liverpool University, graduating with a first-class Bachelor of Science degree in 1922, his

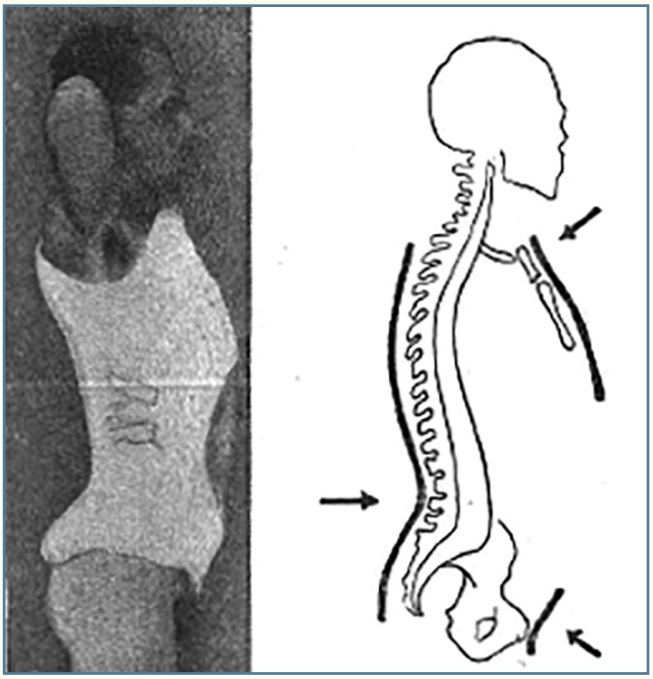

Fig. 15
On the left is a plaster jacket (side view) for the L1 vertebral fracture and markings on the plaster, on the right is a schematic representation of all support points of the jacket [2]

Bachelor of Medicine and Surgery degrees two years later, and a Masters of Orthopedic Surgery in 1926 (Fig. 20). He will be remembered as one of "most brilliant students of the school then and since", winning numerous prizes and earning a number of prestigious scholarships. In 1923, he became a lecturer in

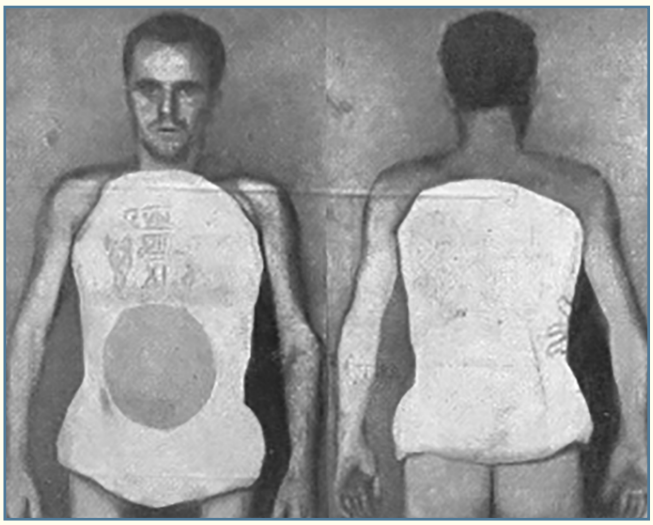

Fig. 16
Plaster jacket: front and back view [2]

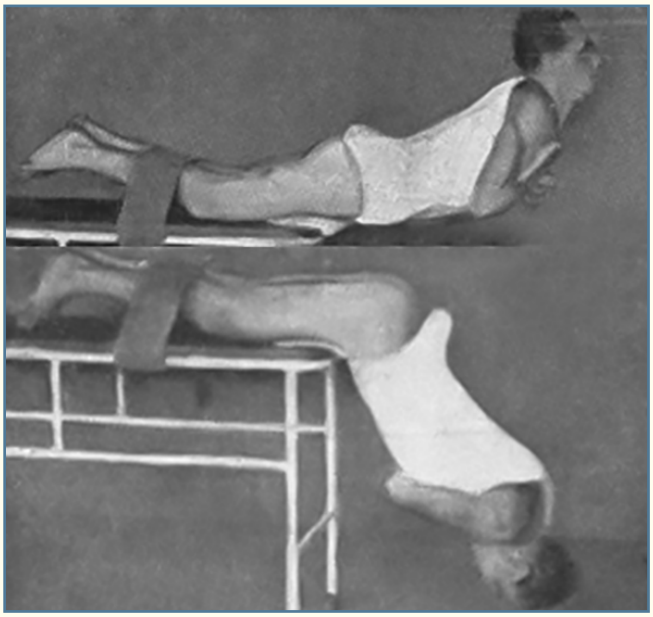

Fig. 17
Plaster jacket: front and back view [2]

Anatomy and Physiology, and received the Joint Diploma at Liverpool in 1924.

While at Liverpool, Watson-Jones worked under the direction of the eminent orthopedic surgeon Robert Jones (of no relation), who recommended him to be appointed honorary assistant surgeon at an infirmary in 1926. In 1927, he was appointed a fellow of the Royal College of Surgeons. He began publishing articles in the Journal of Bone and Joint Surgery in the early 1930s and produced an average of three a year from then on. His contributions earned him recognition, and in 1936 he began teaching at Liverpool University that made him to work on a textbook "Fractures and Joint Injuries" published in 1940. It was 15 times reprinted, translated into all European languages, and called a "masterpiece." This textbook was written in clear and understandable language and became a valued guidebook to field surgeons in World War II. In 1937, Watson changed his surname to "Watson-Jones" but kept "Watson" as a separate middle name to distinguish himself from many of the other people called Jones in Liverpool.

During the early years of World War II, Watson-Jones remained a civilian consultant to the Royal Air Force. He set up ten units of 100–150 beds each across the United Kingdom to allocate recovering pilots; his emphasis of rehabilitation meant that many were able to return to active service. In 1942, he established the Department of Orthopaedics and Accidents at the London Hospital, and in 1945 he was knighted. Three years later, he was instrumental in establishing the British volume of the Journal of Bone and Joint Surgery (BJBJS) and became

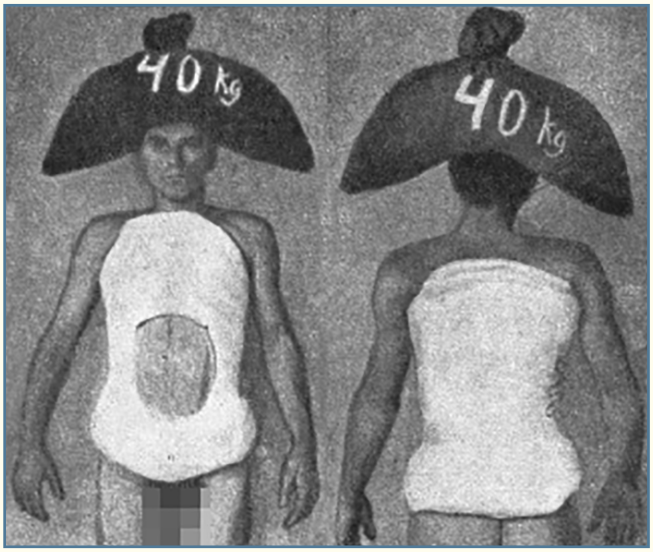

Fig. 18
To strengthen the muscles of the neck and back, a patient wears a sandbag on his head twice a day for 15–30 minutes with a weight increasing from 5 to 40 kg. Active extension of the spine occurs, with the load falling on the undamaged posterior sections of the vertebrae. Duration of treatment is 8 weeks [2]

Fig. 19
After five weeks of exercise, the abdominal muscles become so strong that they can support up to 108 kg [2]

its editor (serving until his death). He pushed back against the establishment of the National Health Service, writing in 1948 that private practice was an essential component of medical progress. He was an orthopedic surgeon to George VI from 1946 to 1952 and to Elizabeth II from 1952 to his death, as well as President of the Orthopedic Section of the Royal Society of Medicine in 1956 and of the British Orthopedic Association in 1952–53. Watson-Jones's surgical activity was characterized by meticulous attention to detail and precision, and he expected no different from his students, while he kept unusually detailed and orderly notes on all his consultations. Watson-Jones's surgical activity was characterized by meticulous attention to detail and precision, and he expected no different from his students, while he kept unusually detailed and orderly notes on all his cases. His work, especially during the war, but before it too, brought new ways of treating fracture into mainstream medical practice, and his publications and work with the BJBJS made it possible for surgeons across the world to use it.

Watson-Jones married twice: firstly, to Muriel Emily and secondly, to Muriel Wallace Robertson, a nurse; he adopted two children with his first wife. He died at the age of 70. A study of his life states that, together with his mentor Robert Jones, he laid the foundations for a strong history of British orthopedics.

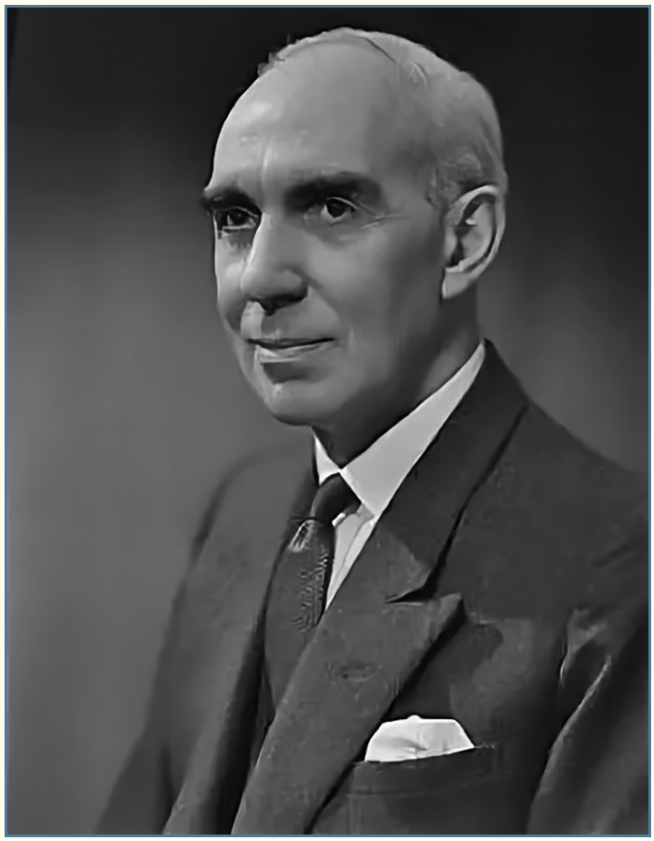

Fig. 20
Reginald Watson-Jones

In the textbook "Bone Fractures and Joint Injuries," (the fifth edition published in 1969 and translated into Russian in 1972), the author describes his treatment techniques for spine injuries using a simple classification, dividing them into three groups: injuries to the transverse and spinous processes and the vertebral curve, injuries to the vertebral bodies, and injuries to the vertebral arches.

If one or two transverse processes are fractured (as the author has mentioned), tight strapping of the lumbar spine for three weeks is sufficient; full range of motion is acceptable after four weeks. Immobilization with a plaster jacket for 6–8 weeks is indicated when several transverse processes are ruptured. Exercises are started after two to three weeks; the intensity of exercises increases after immobilization is ended.

According to the author, the spinous processes are injured by a sudden muscle contraction. He refers to the study of Debuch, who described 187 such injuries and called them "Clay-shoveler's fracture" – when plunging a shovel into the ground and throwing the soil upward, a sharp pain occurs between the shoulder blades. The radiological examination confirms the presence of a ruptured fragment of the spinous process. Treatment includes bed rest and exercises. In rare cases, the ruptured fragment of the spinous process can be removed. Watson-Jones emphasizes that the German Debuch described 187 such injuries in two years, while in England few surgeons have seen more than one or two such cases. It is difficult to say what he meant by this.

Watson-Jones categorized thoracic and lumbar spine injuries into flexion, splitting, dislocation fractures, and extension according to the mechanism of injury; and into stable and unstable (subject to and not subject to displacement) according to stability. In complicated cases, the radiological examination was supplemented with spondylograms done in the flexion position, as this improves the clarification of the nature of the injury. Moreover, radiological images in flexion position are recommended to be repeated after 10–14 days ("regular" images) in order to diagnose a suspected fracture. Today, this approach is somewhat odd, but whatever happened, happened, and we are not here to judge our colleagues who worked in completely different conditions.

In the case of simple compression fractures, when the interosseous ligaments are intact and it is evident that the deformity is not prone to progression, bed rest for 2–3 weeks with mild hyperextension using a pillow will be enough. Then – active exercises; and return to work 2–3 months after. If the fracture is "exposed to displacement," the vertebral end plate will break, and the trabecular bone of the vertebral body will *"deflate near the interarticular line like a harmonica"*. In such cases, Watson-Jones used a fracture reposition technique based on hyperextension of the vertebral column. This technique, in turn, dates back to the suggestion of Davis, who in 1929 performed extension under general anesthesia with the patient in prone position. Leg traction was performed on a high hanging block. After repositioning, a plaster bed was made from head to knees for several months. A year later, Watson-Jones described

his technique to treat fractures. A patient, without anesthesia, is placed on two tables of different heights (the difference in height is 25–30 cm) so that the surface of the lower one reaches the upper third of the thighs, and the upper one does not reach the chest (Fig. 21). In this position, the patient's body sags in a position of maximum possible hyperextension of the spine. No additional procedures are required; the body weight is sufficient. The body *"finds its own range of overextension"* in the absence of support, and this is the only position where the anterior longitudinal ligament becomes tight enough to provide for vertebral fragment reposition. Then a plaster jacket is applied from the groin to the clavicles, and such immobilization continues for up to 4–6 months along with exercises.

Watson-Jones recommended surgery for comminuted fractures of the thoracic and lumbar spine. These injuries are radically different from compression fractures since they result from a completely localized flexion of considerable force. The bone is shattered, the intervertebral discs are ruptured, the diarthrodial joints are injured, the vertebral arches may be fractured, and bone fragments may be displaced into the spinal canal. Conservative treatment of such severe injuries is inefficient; therefore, Watson-Jones suggests spinal fusion using an autologous bone graft from the iliac crest. He highlights that ankylosation of three vertebrae (the injured vertebra and both adjacent vertebrae) is sufficient to achieve the desired effect. He points out that *"there is no need for fixation with plates and screws"* in case of spinal cord injury, but does not specify what and how should be fixed in this case. Immobilization with a plaster jacket lasts 3–4 months.

Not all fractures, according to the Watson-Jones concept, could be treated with hyperextension. Four types of injuries required differentiated strategy. The first one is a dislocation fracture with closure of the articular processes, when an effort to hyperextend is associated with the development of paraplegia. In this case, an open approach to repositioning of the vertebra with resection of the articular process is required. The second type is rare extension fractures, the third type is comminuted fractures with injury to the posterior vertebral end plate, and the fourth type is traumatic spondylolisthesis. Most of them should be treated in a conservative manner.

Watson-Jones identified also four types of cervical spine injuries: sprains of the cervical plexus, dislocations and incomplete dislocations of the vertebrae, dislocations of the diarthrodial joint, and extension injuries of the intervertebral discs. Fractures and dislocations of the atlas are treated separately. Dislocations and incomplete dislocations are treated by immobilization with an extension plaster collar for two months. In flexion dislocations of the articular process, traction is done before extension, and immobilization is performed with a large plaster jacket. Traction of the calvarial bones is optimally performed using an Anderson clamp. In extension injuries, immobilization with a soft (felt) collar is sufficient. In most cases, C2 vertebral injuries are treated with plaster immobilization for three weeks.

Vertebral fractures and dislocations with paraplegia (Watson-Jones's definition) are a specific section of vertebrology. These injuries, like those described above, he subdivided into four subgroups: spinal concussion, crushing of the spinal cord, injury to the spinal roots and cauda equina, and injury to the spinal cord and roots at the thoracolumbar junction. The latter group is identified as an independent one due to a possible transverse break of the spinal cord at this level.

Laminectomy is indicated in cases of vertebral arch fracture with displacement of the fragment into the spinal canal lumen, in case of incomplete break of the spinal cord, when neurological signs are aggravated, suggesting the possibility of an epidural hematoma, in case of complete or incomplete paraplegia, when the fracture is not determined radiologically, and there is no cerebrospinal fluid leakage on puncture.

V.V. Gorinevskaya

Valentina Valentinovna Gorinevskaya was born in 1882 in St. Petersburg in the family of a professor, one of the founders of the medical faculty in Samara. She graduated from the Women's Medical Institute and was admitted to the Petropavlovsk Hospital as an assisting surgeon in the surgical clinic (Fig. 22).

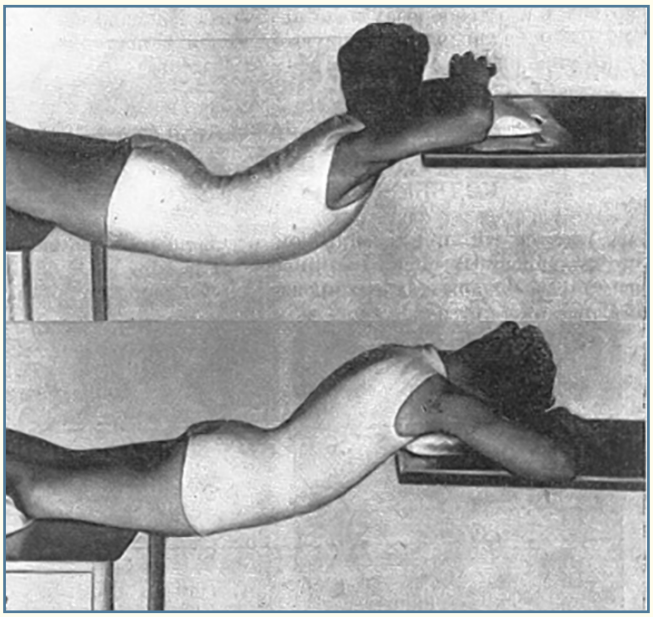

Fig. 21
Reposition of the fractured vertebral body according to Watson-Jones: above – correct position during repositioning (the lower table reaches the upper third of the thighs, the upper table is positioned so that the chest sags); below – incorrect position during repositioning (the lower table goes beyond the upper third of the thighs, the upper table is located close to the chest). An effective extension of the spine becomes impossible with incorrect positioning [6]

During World War I, V.V. Gorinevskaya worked as a surgeon in hospitals on the Western Front. The next 6 years she supervised the surgical units of the Samara Governmental Hospital, the V. A. Obukh Institute for the Study of Occupational Diseases, and the Traumatological Department of the Institute of Therapy and Prosthetics in Moscow. In 1932, she was appointed to be the head of the traumatology unit at the N.V. Sklifosovsky Institute. She chaired the Department of Traumatology at the Central Institute of Postgraduate Medical Training and taught traumatology at two Moscow medical institutes. In 1936, the guidelines "Fundamentals of Traumatology," authored and edited by Valentina Valentinovna, was published. It underwent three reprints and became a hands-on desk reference of that time. V.V. Gorinevskaya participated in the medical support of military campaigns on the Khalkhin-Gol in 1939 and during the Soviet-Finnish war. In 1940, under the editorship of V.V. Gorinevskaya and E.F. Dreving, the book "Remedial Gymnastics in Traumatology in Peacetime and Wartime" was published. Together with E.F. Dreving, she developed an original functional technique for the treatment of spinal fractures. During the Great Patriotic War, Valentina Valentinovna was an inspector-consultant of the Main Military Health Department of the Red Army and until 1953 headed the Department of Field Surgery of the Military Medical Faculty at the Central Institute of Postgraduate Medical Training.

V.V. Gorinevskaya is justly recognized as one of the founders of traumatology in the USSR. She was a board member of many academic societies and editor of the "Surgery" section of the Encyclopedic Dictionary of Military Medicine. Valentina Valentinovna wrote about 90 scientific papers, including 9 monographs and guidelines.

In the above-mentioned comprehensive guideline, unlike many other authors, she paid attention to the concept of distortion (distorsio) since it seems "clinically and pathologically" underspecified. *"We refer to distortion, a spinal sprain, understanding it as a disorder of the ligamentous apparatus – ruptures and tears of the joint capsules and ligaments ... that result in neither displacement nor permanent impairment of spinal function. Without sufficient data for a diagnosis of distortion, we include here traumatic diseases of the spine that are not associated with any specific changes in configuration, do not reveal any changes on radiological images and do not cause significant functional disorders. Sharp pain after injury or lifting heavy items and limitation of motion are the main symptoms of distortion. The diagnosis ... can be made with assurance only by excluding injuries to the bony skeleton from ... neurological and radiological examination and case study"*.

According to Gorinevskaya, the treatment of uncomplicated compression fractures of the spine should be performed using skeletal traction on an inclined surface to increase the effect of traction (Fig. 23) – with an axillary or Glisson loop (for cervical and upper thoracic injuries). She believed that it was correct to transfer the functional technique of treating extremity fractures to the spine without subsequent immobilization with a plaster jacket. A properly designed system of exercises should contribute to the formation of a muscular system sufficient for rapid rehabilitation and return to work. Standing up is allowed after three months, but sitting is much later. This technique, known in Russian literature as the method of V.V. Gorinevskaya and E.F. Dreving, according to the authors, has proved to be the best.

Arguing against L. Beler (in his absence), V.V. Gorinevskaya writes: *"In ordinary compression fractures, good outcomes can be achieved by properly adjusted traction in bed. As for the subsequent blocking up of the patient in a huge plaster jacket, although B hler gives a number of photos of acrobatic exercises in such a jacket, we still know that these exercises in a jacket are very difficult, limited, performed with great effort, and inefficient. Typically, however, being in a jacket for a long time without exercise results in atrophy of the ... muscles"*.

Describing in detail the diagnosis, treatment, and care of patients with complicated spinal fractures, V.V. Gorinevskaya limits herself in description of surgical treatment to the following passage: *"During the imperialist war, the laminectomy, consisting of the removal of the arches of injured vertebrae and bone fragments penetrating into the spinal canal* (so the author

Fig. 22
V. V. Gorinevskaya

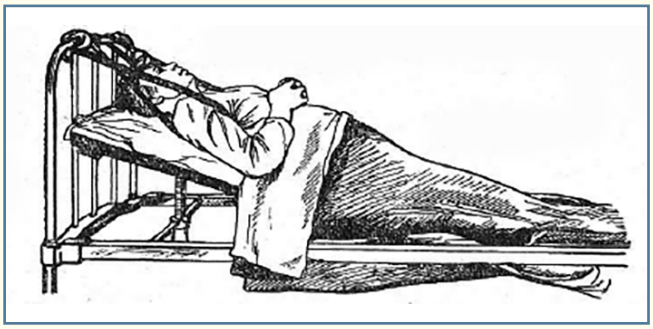

Fig. 23
Conservative treatment according to Gorinevskaya: traction on an inclined plane [4]

says), *became widespread. The surgery shall be performed very carefully and attentively, in order not to injure the spinal cord; if there is a subdural hematoma ... the dura mater shall be opened, and blood clots compressing the spinal cord shall be removed".*

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