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Historical Aspects of Congenital Inguinal Hernia in Children

Ana Fedoruc[1]
[1](*Nicolae Testemitanu State University of Medicine and Pharmacy, Republic of Moldova)*

Abstract : Congenital inguinal hernia is one of the most common surgical conditions in infants and one of the most discussed topics in pediatric surgery. Despite numerous descriptions in the literature on the subject of inguinal hernias, the main principle of treatment in infants and children has been insufficiently considered, with most descriptions devoted to inguinal hernias in adults. We present the first methods of resolving inguinal hernias in children that underlie contemporary treatment.

Keywords - *inguinal hernia in children*

Over the centuries, the history of the diagnosis and treatment of inguinal hernia has presented some remarkable aspects, with multiple reports on adults, but almost no studies on children [1]. Although until the eighteenth century, this condition was researched with interest and elucidated in the books of several important authors of the time, in reality, it was treated more by empiricists and hairdressers [2]. Until the 19th century, the treatment of hernias in adults and children was virtually similar, with conservative approaches with extensive use of bandages predominating in children. Subsequently, anatomical findings and knowledge of the pathogenesis of congenital inguinal hernia in children have contributed to the development of effective surgical procedures to resolve this pathology [3].

The word "hernia" comes from the Greek "kele/hernios" and means "bud" or "shoot." [4]. The first mentions of the existence of this condition come from antiquity, being present in manuscripts found in Mesopotamian and Egyptian cultures. The earliest descriptions have been found in ancient papyri from Egypt, such as the Eibers Papyrus, which dates from around 1552 BC. According to this manuscript, hernias were considered "tumoral formations, which occur as a result of coughing" and were treated with tight bandages applied by early Alexandrian physicians. Evidence of this is a Phoenician statuette from 900 BC, depicting a bilateral inguinal hernia treated as follows [5, 6]. At that time, Egyptian surgeons practiced a surgical approach to inguino-scrotal hernia, which consisted of excision of the hernia with orchiectomy, strangulated hernias being considered inoperable. In this context, the work of Lau W.Y. (2002) gives some examples described by some authors, such as the mummy of Pharaoh Merneptah (1215 BC), which had an incision in the inguinal region with a removed testicle, or the mummy of Ramses V (20th dynasty, 1156-1151 BC), which had a huge hernial sac in the inguinal area [7]. It should be noted that celiotomy was used in India by Hindus in the Brahmanic era (800-500 BC) and by Greek physicians, with the exception of Praxagoras (350 BC) [8]. In Ancient Greece, the first risk factors in the development of hernias were also identified, and they were found mainly in people who practised certain professions: tailors, blacksmiths, farmers, fishermen and horsemen. According to Hippocrates (460 - 377 BC), those suffering from hernias had less timeliving. He also mentioned inguinal hernias in children, making a clear distinction between hernia and hydrocele [8]. On the other hand, the Roman physician-

encyclopedist, Aulus Cornelius Celsus (25 BC - 50 AD), made the first description of the different types of hernias, many of the original descriptions are still preserved today [3]. He applied surgical treatment of the hernia, the operation consisting of separating the hernia sac from the spermatic cord to save the testicle, the wound being left without sutures in the process of granulation (the scar was to strengthen the abdominal wall and prevent recurrence) [9].

Herniation of the ovary and fallopian tube in the Nuck canal was first mentioned in the writings of Soranus of Ephesus (97 AD) [10]. Claudius Galen (130-210 AD), known as one of the most important physicians of the Greco-Roman period, resorted to the surgical treatment of inguinal hernias, which consisted of ligation of the hernial sac together with the spermatic cord and resection of the testicle [11]. He also made the first description of the permeability of the vaginal process, which contributes for development of congenital inguinal hernia or hydrocele (176 AD) [3].

In the Middle Ages, surgical techniques were not significantly different from those of the ancients, and operations were carried out not only by conmen or itinerant barbers, but also by famous doctors. The Italian surgeon, Fabricius, performed about 200 herniotomies a year, the Swiss Paracelsus performed 300 such operations, and successive generations of the Norsini dynasty far surpassed earlier performances [12]. Another achievement of those times is the transfixion of the cord to the external inguinal ring [8], which was illustrated in Stromayr's manuscript of 1559.

Pierre Franco (1500-1561) published the first treatise on hernias and was the first surgeon to operate on a strangulated hernia [11]. Franco rejected castration as an unnecessary mutilating practice, but considered necessary by most surgeons in the Middle Ages, and demonstrated that hernias could be operated on very easily without removing the testicle while preserving the spermatic duct [13].

Among the physicians who categorically opposed surgical treatment was the Frenchman Ambroise Paré (1510-1590) [14], who argued that hernias in children were prone to rupture and that the best treatment was to apply tight bandages. He was also against en bloc ligation of the spermatic cord to the hernia sac during surgery to heal inguinal hernias and was against removal of the testicles. Ambroise Paré is credited with the first description of incarcerated inguinal hernia in children [3, 11].

More detailed and accurate understanding of inguinal hernia anatomy contributed to the development of relatively successful surgeries in the 18th and 19th centuries [3]. In 1716, Demetrius Cantemir (1673-1723) published the first report of successful transabdominal repair by Albanian surgeons. A few years later, Lorenz Heister (1683-1758) reported that in 1701 Jean Méry, surgeon at the Hôtel-Dieu in Paris, resected by laparotomy the necrotic intestine in a case of strangulated inguinal hernia. The works of Antomio Scarpa (1752-1832), Franz Kaspar Hasselbacj (1759-1816), Astlei Paston Cooper (1768-1841), Alexander Thomas (1813-1849), who made a considerable contribution to clarifying aspects of the regional anatomy of the inguinal area, should also be noted [11].

The modern era of hernia surgery was based on the contributions of Eduardo Bassini, who, in 1884, elucidated the anatomy of the inguinal canal, and in 1887 proposed a safe and effective surgical procedure to repair inguinal hernia, based on muscular strengthening of the posterior wall. This process was later modified by William Stewart Halsted (1852-1922) and Edmund W. Andrews (1824-1904). In the following years, several authors proposed different types of modified surgical techniques, including Ernest Juvara (1870-1933), who in 1897 published the paper "Modifications de la procédure de Bassini pour le traitement de la cure de l'hernie inguinale", in the first issue of the Romanian Journal of Surgery, whose co-editor was, together with the renowned professor, Thoma Ionescu (1860-1926) [6, 11]. The principle of anterior preperitoneal repair of inguinal and femoral hernia has been advocated by several illustrious surgeons such as Annandale T. (1876), Ruggi G. (1892), Lotheissen G. (1898), Moschowitz A.V. (1907) etc. [15].

In 1920, George Lenthal Cheatle (1865-1951) resorted to a totally extraperitoneal approach, which was first performed as a radical curative operation for both inguinal and femoral hernias, using the preperitoneal approach through a lower median abdominal incision [16]. An original method of repairing the posterior inguinal wall was proposed by Albert Narath (1864-1924) and advocated by Georg Lotheissen (1898), which consisted of using Cooper's pectineal ligament for repair. This technique was quite widespread after its reintroduction by Chester McVay (1939), who first used the Cooper ligament for repair.

The first description of a congenital inguinal hernia is attributed to Percival Pott in 1756 [17]. The famous Dutch physician, Petrus Camper (1722-1789), was considered a pioneer in the treatment of inguinal hernias, performing dissections on cadavers of children and adults to study the anatomy and aetiology of inguinal hernias. His work, "Icones Herniarum", included a number of remarkable anatomical illustrations. [18, 19].

In 1871, Henry O. Marcy, a Boston surgeon, reported two cases of inguinal hernia repair in which high ligation and excision of the hernial sac were performed, with narrowing of the internal inguinal ring by two carbolized catgut sutures. During this procedure, transverse fascia plating was performed and sufficient space was left for the spermatic cord [20]. Later, complex studies have emerged and formed the basis of modern herniology. In 1881, Lucas Championnieri performed high ligation of the hernial sac at the internal inguinal ring after splitting the abdominal aponeurosis in the oblique inguinal hernia, laying the foundation for the most important repair procedure for inguinal hernia surgery [21]. In 1882, Sir William Mitchell Banks first described a technical procedure of herniotomy, commonly used in children, which consisted of mobilization of the hernial sac outside the external ring, high ligation and excision of the sac without resorting to incision of the aponeurosis of the oblique muscle and external ring [22, 23].

The first steps in simplifying the surgical treatment of indirect inguinal hernia, especially in children, were made by Ferguson A.H. in 1899. His procedure involved exposure, high resection of the vaginal process, the anterior wall of the inguinal canal being reinforced without transecting the "funiculus spermaticus" [24].

The idea that the hernia could be resolved by injecting solutions that would stimulate fibrosis is not new. In 1835, Velpeau in Paris observed a hernia that had been healed by accidentally introducing iodine into the canal while injecting a hydrocel, and later treated hernias with iodine injections. In 1836, Joseph Pancoast cured thirteen cases of hernia at the Philadelphia General Hospital by injecting Lugol's solution into the canal. In 1843, George Heaton reported in the Boston Medical and Surgical Journal a case of treating hernia by injections, proving good results, and in 1877 he wrote a book on the subject [25].

In 1908, Fagge C.H. described the following absolute indications for the surgical treatment of inguinal hernias in children: 1) hernias which cannot be maintained with bandages or which are painful when bandages are worn; 2) a large scrotal hernia which has caused considerable distention of the inguinal canal and therefore necessitates lifelong bandaging; 3) the association of an unbordered testicle with an inguinal hernia; 4) a hernia which was previously irreducible. This does not include strangulated hernias, which must be treated immediately [26].

In 1913, Arthur N. Collins reported, after extensive analysis, several cases of strangulated inguinal hernia in young children, the youngest of whom was only 45 hours old and successfully operated on by Andrews in August 1874. The author concluded that the urgency of treatment is greater in infants than in similar situations occurring in adults, due to the rapidity of necrotic changes following circulation disturbances and early development of shock. At the same time, he mentioned the rigor in treating the hernia sac, the risk of injury through manipulation, and the danger of removing the sac [27].

English and Scottish surgeons, notably Turner Ph. in 1912 and Mac Lennon A. in 1914, considered it necessary to further remove the sac at the level of the inner ring by a very small incision. In 1925, Russel R.H. stressed the importance of his long-accepted doctrine of surgical removal of the sac only in the treatment of hernia in infants and children. In the same year, Herzfeld G. initiated outpatient surgery for children with inguinal hernias, and in 1938, in a report from the Royal Hospital for Children in Edinburgh, he recommended a small incision to be made over the external ring, with downward pulling of the sac, whose ligation with closure of the external ring should be performed with a single suture [1].

In 1941, William E. Ladd and Robert E. Gross published the first manual of pediatric surgery, in which they described and systematized the open technique of inguinal hernia repair in children [28]. In 1945, Coles J.S. recommended transecting the sac, transfixing and ligating the proximal end as high as possible and allowing the distal portion of the sac to fall back without further treatment [29]. Iason A.H. (1945) described the following complications occasionally encountered in inguinal hernia operations, including: 1) lesions of the spermatic cord, with sequelae of thrombosis of the veins and subsequent infarction of the testicle; 2) lesion of the spermatic artery, with or without necrosis or atrophy of the testicle; 3) division of the vas deferens; 4) lesion of the bladder; 5) lesion of the inferior or deep epigastric blood vessels; 6) lesion of the external iliac vessels; 7)

lesion of the intestine; 8) lesion of the omentum [30]. At the same time, several unusual pathological conditions have been observed in the groin area in infants and children during surgery, including male pseudohermaphroditism, ectopic spleen, ectopic adrenal with neuroblastoma, bladder diverticulum, groin adenitis and suppurated iliac adenitis. In all these cases, careful identification of all anatomical structures is absolutely mandatory [31].

In 1950, Potts W.J. et al., reviewing the results of the treatment of typical inguinal hernia in 600 infants and children, conclude that the procedure of choice is surgical removal of the sac without elevation of the cord structures and without any plastic repair of the muscles or fascia of the inguinal region, finding only a questionable recurrence in a three-year-old child [32].

Some authors have recommended bilateral herniotomy in healthy infants and children, regardless of age, gender, family history of hernia, history of prematurity, or those previously undergoing elective unilateral herniorrhaphy. Their recommendations were based on some studies, which demonstrated the presence of a patent vaginal process (potential hernia), identified on the contralateral side (asymptomatic side) in 60-70% of patients admitted with a single clinical hernia [33]. In 1955, Rothenberg R.E. and Barnettl T. reported 50 cases of unilateral inguinal hernias in infants and children who had contralateral inguinal explorations, finding that 100% of infants under one year of age and 65.8% of children over one year of age had "bilateral inguinal hernias" [34]. There have been several similar reports confirming the high incidence of an open vaginal process on the opposite side of clinically apparent inguinal hernia, such as the work of Mueller and Rader (1956), McLaughlin and Kleager (1956) [33]. In this context, in 1959, Kiesewetter W.B. and Parenzan L. pointed out that contralateral surgery on the asymptomatic side is justified, presenting a long-term follow-up analysis of 237 patients who underwent unilateral hernia repairs at less than two years of age. Of patients who underwent right-sided hernia repair, 32% returned with a left-sided hernia. In the sixty-eight patients who underwent left inguinal herniorrhaphy, right inguinal hernia developed subsequently in 28% of cases. These statistics were at variance with the results of other studies, such as those carried out by McLaughlin C.W. and Coe J.D. in 1960, where in a sample of 329 infants and young children the incidence of hernia on the opposite side was 55%, 49.3% if the initial hernia was on the right side and 69.6% if the primary hernia was on the left side. At the same time, the issue of routine surgical exploration of the asymptomatic inguinal canal in patients with unilateral hernia has been investigated from an entirely different perspective [35, 36]. Sparkman R.S. (1962), who analysed a group of 918 infants and children with unilateral inguinal hernia, found the presence of contralateral vaginal process in 57% of cases. Some studies have observed that girls have a higher incidence of a contralateral patent vaginal process compared to boys, but have the same incidence of bilateral inguinal hernias as boys. This, according to the authors, suggests that the presence of a contralateral vaginal process is not necessarily the cause of the development of an inguinal hernia [37]. In addition, autopsy data show that adult decedents who did not suffer from clinical hernia had a patent vaginal process in 15 to 30 percent of cases [38].

Based on conflicting opinions, Ducharme J.C. et al. (1967) recommended herniorrhaphy by injecting a contrast agent into the peritoneal cavity, an idea subsequently supported by several authors [39]. According to some studies, this radiological method of diagnosis has produced about 95% conclusive results, with false positive diagnoses constituting 2% and false negative 3%. [40].

Less attention has been paid in the literature to the pneumoperitoneum procedure in the preoperative diagnosis of inguinal hernias, first described by Farr R.E. (1924). Arner O. and Fernstrom I. (1970) reported on the use of this procedure in the preoperative diagnosis of clinically uncertain inguinal hernias. In 1973, Shiozaki A. et al. reported the use of intraoperative diagnostic pneumoperitoneum in 49 patients, with no complications and an accuracy rate of 83.7%. Bulow W. (1974) studied 117 patients using this technique, demonstrating in 14% of the subjects the presence of a contralateral hernia, with no false positive results and one false negative result, and the only complication observed was a case of localized subcutaneous emphysema, which resolved spontaneously. Singh J.P. et al. (1974) performed a prospective evaluation of preoperative pneumoperitoneum with preoperative inguinal herniorrhaphy. They found that pneumoperitoneum was more reliable than inguinal herniorrhaphy, with a 98.4% accuracy rate, fewer complications and fewer technical malfunctions [41].

In the 1950s, early inguinal hernia repair in children and adolescents was not universally accepted as the treatment of choice, despite a growing number of articles in the literature [42]. In the early 1960s, the principles of treatment of inguinal hernias in infants and children changed significantly. Not so long ago, surgery in infants

was indicated only in incarcerated hernias and was recommended for any asymptomatic hernia only after the child had grown. Today, however, an infant's hernia is repaired electively, regardless of age. At one time, complete repair of the inguinal canal was an acceptable treatment modality, but later, simple ligation of the sac became the treatment of choice. In the past, children were forced to stay in bed after surgery and hospitalisation lasted up to ten days to ensure successful healing. Subsequently, the period of hospitalisation has varied from 24 to 48 hours [43, 44]. In 1989, Grosfeld J.L. suggested that all full-term infants and older children without underlying pathology could have outpatient hernia surgery, which is safe, effective and well tolerated. [45].

Some authors have presented specific recommendations for incarcerated hernias, including elective inguinal herniorrhaphy which should be performed promptly in all children, especially infants. Thus, the success rate in avoiding incarcerated inguinal hernia operations will prove to be 75% to 80% of cases. Elective herniorrhaphy should rarely be "postponed" and only temporarily if there is an intercurrent infection or severe anaemia [46].

In 1979, Fletcher P. first used a laparoscope to repair an inguinal hernia, subsequently Ralph Ger (1982), S. Bogojavalensky (1989), Leonard Schultz (1990) and Maurice E. Arregui (1992, 1993) presented their techniques for transabdominal preperitoneal repair [14]. The use of laparoscopy in the exploration of inguinal hernias in infants and children began in 1992, demonstrated a high degree of accuracy compared to alternative methods in detecting an inguinal hernia or asymptomatic contralateral patent vaginal process [47]. Laparoscopic repair of inguinal hernia in children is an alternative method of treatment, the primacy of its approach being disputed between Montupet (1993) [48], Șcebenkov M.V. (1995) [49] and El-Gohary M. (1997) [50].

Thus, although over time, multiple retrospective studies have been published and remarkable results recorded, there is little prospective research, meta-analyses or systematic reviews on the problem of inguinal hernias in children, and there is an ongoing and controversial discussion on the optimal management of this condition according to age, gender or the presence of complications.

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