

HISTORY OF INGUINAL HERNIA REPAIR.

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HISTORY OF INGUINAL HERNIA REPAIR (ABSTRACT): Inguinal hernia most probably has been a disease ever since mankind existed. In view of its existence in different kinds of animals, and in particular of primates, one can assume that already prehistoric human beings were affected with the disease. Inguinal hernia repair has made enormous progress throughout the ages. The main reasons for intervention however remained the same: continuous growth of the inguinal and/or scrotal swelling, the risk of incarceration of the hernia content and the bad results of conservative methods like truss placement. Surgical techniques have rapidly evolved since Eduardo Bassini proposed his first successful reconstruction of the inguinal floor. The various adaptations of his technique did however not result in a substantial reduction in the number of recurrences. The tension free repair, introduced by Irving Lichtenstein, caused a dramatic drop in the recurrence rate and became the procedure of choice. Since the introduction of laparoscopic techniques, these methods became equally accepted for inguinal hernia, in particular in western regions where financial aspects play a less prominent role. The future will tell how hernia repair will evolve in the next decades.

KEY WORDS: INGUINAL HERNIA, HERNIA REPAIR, HISTORY OF SURGERY.

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INTRODUCTION

Inguinal hernia most probably has been a disease ever since mankind existed¹.

In view of its existence in different kinds of animals², and in particular of primates³, one can assume that already prehistoric human beings were affected with the disease⁴. Written proof of this statement became available from manuscripts and finds in Mesopotamian⁵ and Egyptian⁶ cultures. So does the famous papyrus Ebers, dating from around 1550 BC, refer to patients suffering from inguinal hernia, quoting its appearance during coughing⁷. Another passage⁸ mentions its treatment:

‘Then you shall say concerning it “This is a swelling of the coverings of his abdomen, an illness which I will treat”. It is the heat of his bladder in front of his belly which creates it. Falling to the ground, it returns likewise. You should heat (“shemen”) it to imprison it in his belly. You treat it like the “sahemen” treatment’⁹.

¹Several publications on the history of inguinal hernia and its treatment have been published in the previous years. They can be divided into four categories: 1. Historical monographs, amongst others René Stoppa et al. in 1998c; 2. Introductory chapters in general survey books on hernia, amongst others Raymond Read in 1989 & 1994, José Patino in 1995, Brendan Devlin et al. in 1998, Fernando Carbonell Tatay in 2001, John Skandalakis et al. in 2002; 3. Articles in journals, amongst others R.I. Carlson in 1956, Michael Sachs et al. in 1997, Wayne Lau in 2002, D.A. McClusky et al., Philippe Bonnichon & Olivier Oberlin in 2010; 4. Articles dealing with specific aspects of the history of anatomy, pathology or treatment of hernia: these will be cited at their respective places in this article.

² See for instance Slatter pp.452-459 and Ramadan & Abdin-Bey pp.57-61.

³ See for instance Sonia Wolfe-Coote p. 1935.

⁴ See Albert Lyons’ internet article (consulted 19.06.2011)

⁵ Hammurabi of Babylon described inguinal hernia. See also Skandalakis et al., p. 29.

⁶ So was the mummy of Ramses V (1157 B.C.) found to have a scrotal hernia and/or hydrocele. See Skandalakis et al. p.29.

⁷ See Lyons and Petrucelli p.92.

⁸ Ebers 872.

⁹ For this translation, see John Nunn p.166.

It remains however unclear if the text refers to application of gentle heat to the protruding mass or to aggressive cauterisation designed to create scarring and ensuing occlusion of the hernia sac¹⁰.

GRECO-ROMAN TIMES

The ‘Old Masters’ of Greek and Roman Antiquity wrote more elaborate treatises on hernia pathology and devoted specific chapters to its origin, symptoms and treatment.

So do we read in the Hippocratic Corpus, that hernia was the result of either drinking water from large rivers¹¹, or experiencing a traumatic event to the belly¹².

In the 3rd century BC, Alexandrian medical scientists clearly advocated surgery for hernia. They obtained preoperative sedation with a root extract of mandrake, while haemostasis was achieved with vascular ligation¹³.

The original manuscripts were lost with the destruction of the library of Alexandria, but were transmitted and later reiterated in Roman times, not the least by the encyclopaedist Aulus Cornelius Celsus (fl.30-50 AD).

He collected the contemporary knowledge on hernia in his ‘*De Re Medica*’, written around 30 AD. Herein he describes reduction of hernia content by taxis, and states that at operation not only haemostasis is realised by ligation, but also that the testes are spared¹⁴.

One century later Heliodorus (fl.125 A.D.) equally avoids castration, and deals with the hernia sac by twisting its neck¹⁵.

Galen (130-200), not only wound surgeon of gladiators, but also physician of two consecutive Roman emperors, ascribed the origin of hernias to rupture of the peritoneum and overstretching of the overlying fascia and muscles¹⁶.

His treatment consisted of a ligation of the hernia sac, together with the spermatic cord, and resection of the testicle¹⁷.

Galen’s words became like a medical Bible and were followed and applied for centuries.

THE MIDDLE AGES.

With the fall of the Western Roman Empire in 476, Byzantine medicine took over this Greco-Roman tradition and the treatments of Galen in particular¹⁸.

However Paul of Aegina (ca.625-ca.690) abstained from amputating the testicle. He either opened the hernia sac and reduced its content into the belly by invaginating it with a probe, or applied cauterisation to the skin, overlying the hernia, aiming at scarring the overstretched peritoneum¹⁹. Incarcerated hernias were apparently not treated, since not mentioned in the texts of the Antique Masters²⁰.

¹⁰See Nunn p.167.

¹¹ See for this passage of Hippocrates: Littré Vol.II p.37.

¹² See for this quote of Hippocrates : Littré Vol.V.pp.81-83.

¹³ According to Patino, p.4, citing Leo Zimmerman & Ilza Veith 1961.

¹⁴See Celsus’ *De Re Medica*, Book VII, Capitula XVIII to XXI. For an English translation of the corresponding passus, see Patino, p.4.

¹⁵ See Read 1994, p.1.

¹⁶ Patino p.4, citing Read.

¹⁷ Patino p.4.

¹⁸ For a comprehensive review of hernia treatment in the Byzantine epoch, see Lascaratos et al., 2003.

¹⁹ See de Moulin p.24.

²⁰ See de Moulin p.24.

Arab surgeons continued hernia treatments in line with Byzantine authors like Aetius of Amida (502-575) or Paulus Aeginetus. The most notorious writer Albucasis (936-1013) discusses hernia at length in chapters 65 to 67 of the *'Maqalat'*, the 30th book of his *al-Tasrif*²¹. In his chapter 67 Albucasis acknowledges that early hernia swellings may reduce spontaneously, but mostly may become permanent through formation of adhesences.

They develop as a consequence of distension and weakening of the inguinal peritoneum and should be treated by cauterisation²².

In chapter 65 the author elaborates on scrotal hernia, called *'oudara maaiya'* or enterocele. Here the author is very reluctant to perform cauterisation. Instead, after placing the patient in a supine position, the hernia is progressively reduced, after which the patient is operated upon, the hernia sac transfixed with a cross stitch, and the testicle removed²³. Finally the scrotum is drained inferiorly.

The Arab influence of cauterising the pubic region in case of inguinal hernia became widely adopted in the western late Middle Ages, in particular through the Latin transcription of Albucasis' *al-Tasrif* by Gerard of Cremona (1114-1187) in Toledo in the late 12th century²⁴.

So did Guy de Chauliac (1298-1368) borrow extensively from Albucasis' textbook. For inguinal hernia he proposes six different treatments²⁵:

1. After skin incision, the hernia sac is transfixed and the distal spermatic cord with the testicle is amputated (method of Galen).
2. Cauterisation of the external swelling with the red hot iron (method of Albucasis).
3. Scar formation by using a *'cauterium potentiale'*, a plaster with escharotic capacity, as for instance arsenic (method of Theodoric of Cervia [1205-1298]).
4. Applying a transcutaneous suture around the spermatic cord, and tying it on an external wooden slat, until the cord becomes sectioned (method of Roger of Salerno [late 12th century]).
5. Incising the suprapubic area and introducing a hot iron cauter directly on the spermatic cord (method of Lanfranchi of Milan [?-1315]).
6. After incision, applying a golden thread around the spermatic cord, to tie it just enough to ensure closure of the hernia sac (method of Guy de Chauliac)²⁶.

The surgical textbooks of Guy became the New Testament in surgery. For more than three hundred years, the different methods were in use, with a progressive preponderance for Guy's technique with the Golden Thread.

²¹ I used the French edition, commented by Saïd Mestiri. See the corresponding chapters on hernia: pp.151-154. There is also the English translation and commentary by M.S.Spink & E.L. Lewis (London: The Wellcome Institute of the History of Medicine; Oxford: The University Press, 1973).

²² Albucasis. Ch.67. *'Let the patient lie on his back, in front of you ; make a transverse incision of approximately three finger breaths', over the neck of the inguinal swelling and dissect the subcutaneous membranes. Then take a wooden stiletto and apply it on the top side of the peritoneal sac, so as to reduce it in the interior of the abdomen; use two good sutures above the stiletto and knot them; then remove the wooden stiletto with care not to section the peritoneum, nor to touch the testicle, as I taught you previously; continue by applying a normal wound dressing; when the sutures fall off, the wound is infecting and the peritoneal retraction prevent recurrence. Cauterisation has the most beneficial effects in the inguinal region.'*

²³ Mestiri, pp.153-154, supposes this citation of orchiectomy may be the result of a faulty transcription, instead of representing Albucasis' idea.

²⁴ See de Moulin p. 30

²⁵ See de Moulin pp.57-58.

²⁶ de Chauliac gives credit to Master Bernard for this technique. For de Chauliac's treatise on hernia, see de Chauliac ff.CCXCII vo. till CCXCVI ro. According to Read, the 'Golden Thread' was later effectively used by Gerard de Metz in 1412.

Most surgeons in the late Middle Ages however remained very reluctant to perform surgery. So did Roland of Parma (fl.1264) follow Albucasis in enhancing taxis of the hernia by using a supine patient position²⁷.

THE RENAISSANCE

Renaissance surgeons dared more than their medieval predecessors perform surgical interventions for inguinal hernia²⁸.

This may on the one hand have been the result of a better knowledge of anatomical structures, on the other of new emerging expertise in instrument making.

Several surgeons benefited from the dawn of printing to ventilate their increased knowledge and ideas concerning such surgical hernia repair.

So did Pierre Franco (ca.1500-1561) publish the first monograph, primarily devoted to herniotomy, and written in vernacular.

In the second edition of his work, published in 1561 under the title '*Traité des hernies*', Franco discusses in detail the nature, cause and treatment of herniation²⁹.

Surgical treatment differed according to the type of hernia.

In the **inguinal form** (bubonocele), Franco remains very conservative and after reduction only uses a plaster or a truss³⁰.

In **scrotal hernia with omental content** (epiplocele) or **with intestinal content** (enterocele) surgical treatment proves indicated and generally consisted of castration at that side.

In **sliding hernia** (hitherto not described in literature) Franco opens the hernia sac, separates the viscera from the peritoneal sac and subsequently proceeds as mentioned before³¹.

Franco for the first time also dares to operate **strangulated hernia**. Via a high scrotal incision a small and flattened rod is introduced into the hernia sac, so as to identify the abdominal muscular hernia defect; then careful reduction could be realised³², after which a similar radical procedure is performed as mentioned above.

According to Franco, forms with gangrenous intestines however were deemed to be fatal³³.

At the time Franco produced his treatises, the German wound surgeon Kaspar Stromayr (?-1566/67) published his '*Practica Copiosa*', in which he elaborates extensively on hernia treatment. In this marvellously illustrated work, Stromayr for the first time presents a **differentiation between direct and indirect inguinal hernia**³⁴.

The work of Franco found its reception in the well-known French surgeon Ambroise Paré (1510-1590) (Fig.1), who took over Franco's account on hernia, and published it in 1564³⁵ without however citing his source!!

²⁷ What is now called a Trendelenburg position!

²⁸ For a more elaborate discussion on Renaissance surgery for inguinal hernia, see Van Hee 2011.

²⁹ See Franco 1561.

³⁰ See Franco pp.26-27.

³¹ See Franco pp.42-44.

³² Therby following the technique previously proposed by Paul of Aegina and Albucasis.

³³ See Franco pp.45-46.

³⁴ See Stromayr 1559.

³⁵ See Paré's *Dix Livres de Chirurgie*.

Paré's treatment is primarily conservative, at least in inguinal hernia³⁶, using a cataplasm and followed by a strong bandage. In every case does Paré add a diet and a purgative to his treatment.



Fig. 1 Ambroise Paré

Paré in a special chapter treats about the '*Point doré*', method chosen only if other treatments prove without result, and if the patient asks for it. After an incision just above the pubic bone, a rod as described above is introduced to reduce the hernia content in the abdomen; subsequently the hernia sac is loosened from testicular vessels and cremaster muscle, using small forceps; then the sac is transfixed with 5-6 golden threads, after which an extra thread ties strongly the hernia sac together with both edges of the wound. This thread is left long outside the wound until it putrefies and falls off.

Just like de Chauliac, Paré also discusses the various other methods of treatment, including cauterisation.

Moreover Paré discusses hydrocele, treating it either with a plaster or a seton consisting of a silk thread inserted through the liquid sac in the scrotum, or else an incision of the sac with evacuation of its content and tent-like insertion of a gauze until cicatrisation³⁷.

In all cases does Paré try at all price to prevent orchiectomy, not only to obviate infection, pain and death, but also to retain generative function³⁸.

17TH CENTURY

In the 17th century Franco's surgical treatments were followed and reiterated in most countries through the textbooks of Paré.

The Silesian surgeon Gottfried Purmann (1649-1711)³⁹ definitively dismissed the cauterizing methods which de Chauliac had taken over from the Arab surgeons. Also in the Low Countries did surgeons mainly use trusses, or perform hernia repairs by means of the '*Golden thread*'⁴⁰.

³⁶ Here the 13th edition of Paré's *Oeuvres* has been used. See Paré p.188.

³⁷ See Paré p.193.

³⁸ See Paré pp.192-193.

³⁹ See Purmann 1692. For an overview on life and work of Purmann, see Sachs 1994.

⁴⁰ See for an outstanding overview on Dutch hernia surgery in the 17th and 18th century: de Moulin pp.230-242.

In their operative treatment for scrotal hernia they now all paid particular attention to the spermatic vessels, since they recognized the danger of inadvertently ligaturing or harming the vessels together with the ligature of the hernia sac, what then could lead to testicular necrosis or gangrene⁴¹.

After elaborate studies in anatomy François Poupart (1661- 1709) in 1695 recognized the importance in hernia pathology of the inguinal ligament⁴², already described previously by Gabriele Falloppio (1523-1562).

18TH CENTURY

In the 18th century renewed and extensive studies of **specific anatomical structures** took place, in particular of the inguinal canal.

Anatomists like Giovanni Lancisi (1654-1720), Petrus Camper (1722-1789), Antonio de Gimbernat (1734-1790)⁴³ (Fig.2), and others gave beautiful descriptions of topographical relations of inguinal structures, in particular of important ligaments.

The Göttingen professor of surgery August Gottlieb Richter (1742-1812) produced a two volume treatise on hernia in 1777-1779, in which for the first time he describes a **strangulated hernia involving only part of the intestine**⁴⁴.

Therapeutically the 18th century saw the first report of a successful transabdominal repair of inguinal hernia⁴⁵. It was published by the Romanian prince Demetrius Cantemir (1673-1723) (Fig.3) in 1716 and relates how Albanian surgeons operated a hernia patient, made a low abdominal incision into the peritoneum, inverted the hernia sac in the peritoneal cavity and tied it with a coarse thread, which was left in the wound.

The abdominal incision was left open, and filled with whites of eggs, that were regularly renewed. The patient was left for more than a fortnight in bed, before being allowed to move. After a month or so the wound got healed, and the patient had recovered⁴⁶!

Some years later, Lorenz Heister (1683-1758) reported that already in 1701 Jean Méry, surgeon at the Hôtel-Dieu in Paris, via laparotomy resected necrotic bowel from a strangulated inguinal hernia, thereby performing definitive bowel diversion⁴⁷.

Moreover, surgeons now more and more tried to spare the testicles and their vasculature during herniotomy. Alas, in view of wound infection and/or bleeding, the testes often became necrotic or atrophic⁴⁸.

19TH CENTURY

In the 19th century anatomical studies continued to reveal specific anatomic structures in the inguinal region.

Many fascias and ligaments today are still known by the names of their discoverers: Antonio Scarpa (1752-1832)⁴⁹, Franz Kaspar Hesselbach (1759-1816)⁵⁰,

⁴¹ See de Moulin p. 238.

⁴² Which Poupart called '*Suspenseur de l'abdomen*'. (1695).

⁴³ The Spanish surgeon Don Antonio de Gimbernat demonstrated the lacunar ligament in 1768, but published it in 1793.

⁴⁴ See Richter 1777-1779.

⁴⁵ See for a history of abdominal hernia repair, Richard Meade 1965.

⁴⁶ For an extensive account of this extraordinary operation, see A. Nicolau 2009.

⁴⁷ See the Dutch edition of Heister, published by Ulhoorn in 1741, p. 914.

⁴⁸ See Read 1994 p.1.

⁴⁹ See Scarpa, 1809. This work was published in French in 1812. Scarpa gave his name to a fascia and to a triangle.

⁵⁰ See his first publication in 1806, called *Anatomisch-chirurgische Abhandlung über den Ursprung der Leistenbrüche*, as well as his later publication of 1814. Herein he describes the interfoveolar ligament.

Thomas Morton (1813-1849)⁵¹, Alexander Thomson⁵². So did Scarpa describe the intimate fusion of intestinal content with the peritoneal lining in a sliding hernia, thereby invalidating the theory of rupture of the peritoneum⁵³.



Fig. 2 Antonio de Gimbernat. Painting - José Teixidor. Barcelona. Museo de Arte Moderno



Fig. 3 Demeitrius Cantemir

Also the English famous anatomist and surgeon Sir Astley Paston Cooper (1768-1841) published new and original anatomical views on the inguinal canal with two publications in 1804 and 1807⁵⁴ (Fig.4). Continuing specific additions of inguinal structures by his 18th century predecessors, Cooper described the therapeutically important pectineal or superior pubic ligament, since then named after him, as well as the transversal fascia, so important in the aetiology of direct hernias⁵⁵.

The 19th century provokes a breakthrough in the treatment of inguinal hernia, not the least because of the introduction of anaesthesia and techniques of asepsis and antisepsis into surgical practice. Prior to these events, it remains difficult to find accounts, quoting postoperative long term results. One can presume that high recurrence rates will have occurred in patients surviving surgical hernia repair.

Anaesthesia and antisepsis in the mid 19th century however now allowed more time-consuming dissections and elaborate techniques in order to diminish the number of recurrences. Particularly anatomical repairs focussing on strengthening the posterior wall of the inguinal canal became feasible⁵⁶.

It was the Italian surgeon Eduardo Bassini (1844-1924)⁵⁷ (Fig. 5), who around 1884 invented such new concept with his muscular reinforcement technique of the posterior wall.

The first publication of this Paduan professor of surgery dates from 1887⁵⁸. Already one and two years later he presented the results of larger series of patients operated upon⁵⁹. His technique consisted of suturing the falx aponeurotica (or conjoined

⁵¹ See Thomas Morton's textbook of 1841. Thomas Morton, got 4 prizes, eventually was admitted to the Royal College of Surgeons in 1835, and was appointed house surgeon at the North London (later University College) Hospital. He became assistant surgeon in 1842, but never was given a professorship. Morton got depressed, what together with obsessive drinking ended in a suicide by taking prussic acid, on 30 October 1849.

⁵² Thomson, 1836-1837, describing the ileopubic tract, later named after him. For a biography, see Rheault et al. pp. 601.

⁵³ See Patino pp.7-8.

⁵⁴ See Cooper 1804 & 1807.

⁵⁵ See Raymond Read 1992.

⁵⁶ In contrast to the non-anatomical concept of cicatrix formation in the past.

⁵⁷ For biographical notes on Bassini, see Read 1987.

⁵⁸ A first series of 38 patients was reported by Bassini at a congress of the Italian Society of Surgeons in Genova in 1887. See Bassini 1887a & b.

⁵⁹ See Bassini 1888 and 1889.

tendon) to the inguinal ligament of Poupart. The results were astonishing. So was the infection rate reduced to 4%⁶⁰.

In 1890 Bassini produced a larger monograph with excellent illustrations, which became the basis of a German translated article that now made him known worldwide⁶¹.

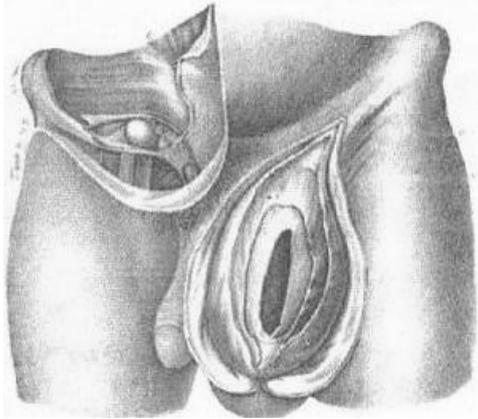


Fig. 4 Sir Astley Cooper - 1804.
Anatomy of the groin region

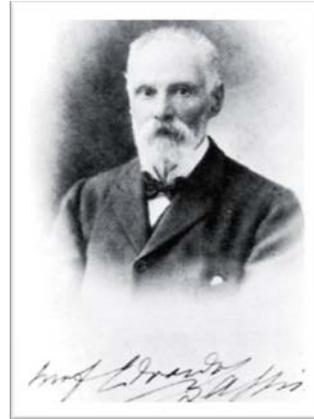


Fig. 5 Eduardo Bassini with his signature

In the following years many authors proposed different types of modifications to Bassini's original technique⁶². One of them was Ernest Juvara (1870-1933) (Fig. 6) from Bucharest in Romania⁶³. He published his '*Modifications de la procédure de Bassini pour le traitement de la cure de l'hernie inguinale*' in 1897, in the first issue of the Romanian Journal of Surgery, of which he was the co-editor, together with the famous professor Thoma Ionescu (1860-1926)⁶⁴, who started the journal.

Around the same time the American surgeon Henry Orlando Marcy (1837-1924) (Fig. 7) presented his technique of high ligation of the hernia sac, combined with narrowing of a dilated inguinal ring⁶⁵.



Fig. 6 Ernest Juvara



Fig. 7 Henry Marcy. *Anatomy of the inguinal canal*

⁶⁰ See Read 1994 p.2.

⁶¹ See Bassini 1890 (Italian) and 1890 (German).

⁶² Notably W.T.Bull 1891, A.Wölfler 1892, W.B.Coley 1895, P.Berger 1902. The famous William Halsted in 1889 transposed the spermatic cord above the external oblique aponeurosis. It became known as the Halsted I procedure. This technique was later followed by Martin Kirschner (1879-1942) and Peter Theodor Hackenbruch (1865-1924).

⁶³ See Palade 2005.

⁶⁴ See Popa et al. 2010.

⁶⁵ Marcy read his first paper on '*Cure of Hernia*' before the Section on Surgery at the 37th Annual Meeting of the American Medical Association in May 1886 (published it in 1887), and edited his marvellously illustrated book on hernia treatment in 1892.

In contrast to Bassini's repair, which proved essentially useful in direct hernia, Marcy's technique was particularly indicated in indirect hernia⁶⁶. His compatriots William Halsted (1852-1922)⁶⁷, Edmund Andrews (1824-1904)⁶⁸ and Alexander Ferguson (1853-1912)⁶⁹ all made some adaptations to Marcy's original technique⁷⁰, and combined it with Bassini's technique, so as to fit the procedure for both direct and indirect hernias.

An original new method of posterior inguinal wall repair, already suggested by Albert Narath (1864-1924) and in 1898 followed by the Austrian Georg Lotheissen (1868-1935), consisted of using the pectineal ligament of Cooper for repair⁷¹. This technique got great acceptance after its reintroduction in 1949 by Chester McVay (1911-1987) and Barry Anson (1894-1874)⁷². However McVay's postoperative low recurrence rates were never matched by other groups⁷³.

20TH CENTURY

General developments in anaesthesia, introducing local forms of anaesthesia, had also their effect on inguinal hernia repair. As a resident in the Johns Hopkins Hospital in Baltimore, the young surgeon Harvey Cushing (1869-1939) (Fig.8) reported hernia surgery under local cocaine infiltration already in 1898⁷⁴ (Fig.9 a & b). Halsted later reported the experiences of his pupil in 1922.

In the 20th century⁷⁵ a new step forward was developed in the 1940's by the Canadian surgeon Earle Shouldice (1891-1965) of Toronto⁷⁶ (Fig.10).

Shouldice proposed a technique based on Bassini's repair, however effectuated under local anaesthesia and consisting of a four layer muscular closure of the posterior wall, using continuous sutures⁷⁷.

His results in terms of recurrence rate were clearly superior to those obtained with previous methods⁷⁸. The technique was taken over by many other teams from the USA or Europe⁷⁹, and became for many years a standard operation⁸⁰.

Many surgeons progressively got persuaded that surgical techniques of hernia repair had to be adapted to specific types of inguinal hernia.

It led several scientists to reconsider the anatomic principles of surgical hernia repair⁸¹, respectively to define and categorise the different types of hernia⁸².

⁶⁶ See Marcy 1887.

⁶⁷ Halsted originally brought the spermatic cord under the skin (the so-called Halsted I technique from 1889), but later abandoned his cord transposition technique and inbricated the aponeurotic flaps of the external oblique as proposed by Edward Wyllis Andrews: it became the so-called Halsted II repair.

⁶⁸ See Andrews 1899.

⁶⁹ Ferguson pointed first at the dangers of cord transposition in view of the testicular atrophy which could follow cord trimming and transposition. See Ferguson 1899 & 1907.

⁷⁰ For a review on the contribution of these American surgeons, see Summers 1947. See also Rutkow 1993a, p.516.

⁷¹ See Lotheissen 1898.

⁷² See McVay 1948 and McVay & Anson 1949.

⁷³ So did Berliner in 1994 report an 11% recurrence rate! See Berliner p. 203.

⁷⁴ See Cushing 1898 & 1900.

⁷⁵ For a selective history of inguinal hernia repair in the 20th century, see Ira Rutkow 1993b.

⁷⁶ See for a historic perspective on Earle Shouldice: Welsh & Alexander 1993, p. 454.

⁷⁷ See Shouldice 1953.

⁷⁸ For results of the Shouldice repair, see Shearburn & Myers 1969.

⁷⁹ See Glassow 1984.

⁸⁰ See Nicholson 1999.

⁸¹ For instance Henri Fruchaud (1894-1960). See also Stoppa & Van Hee 1998a.

⁸² Early classifications included those of Kaspar Stromayr in 1559, reiterated in 1844 by Astley Cooper (indirect and direct hernias), and more recently those by Casten D.F. in 1967 and Gilbert A.I. in 1989.

So did the Shouldice clinic propose a so-called TSD classification, according to T(ype), S(tage) and D(imension) of the hernia⁸³.

A more worldwide accepted classification was presented by Lloyd Nyhus⁸⁴, who distinguished 4 types of hernia

- Type 1: indirect hernia with normal inguinal ring
- Type 2: indirect hernia with dilated inguinal ring
- Type 3 A: direct hernia; 3 B: pantaloon hernia; 3 C: femoral hernia -- Type 4: recurrent hernia⁸⁵.



Fig. 8 *Harvey Cushing, aged 29*



Fig. 9a *Cushing.Patient, three weeks after right hernia repair, with lstill present left hernia*

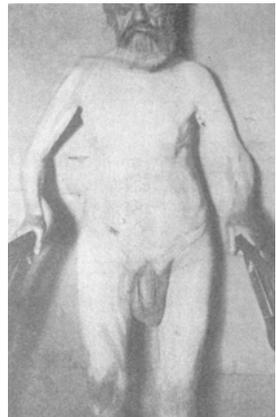


Fig. 9b *Cushing.Same patient three weeks after left inguinal hernia repair*



Fig. 10 *Earle Shouldice*

TENSION FREE REPAIR

The various above cited operative techniques all induced a musculo-ligamental form of repair under tension.

Such tension was held responsible for the since Bassini only slowly diminishing recurrence rates⁸⁶. In various series, circa one out of ten patients indeed continued to develop a recurrence⁸⁷.

⁸³ See for details Robert Bendavid, 1994.

⁸⁴ See Nyhus et al. 1993.

⁸⁵ See Lloyd Nyhus 1993, pointing to the importance of the classification in relation to surgical repair.

⁸⁶ So did Condon & Nyhus in 1989 report following recurrence rates: indirect hernia 0-7%; direct hernia 1-10%; 5-35% recurrent hernia.

⁸⁷ See a Californian statistical report from 1983 (see Anonymous: 'Conceptualization and measurement of physiological health for adults', 1983).

To cope with this tension, at first relaxing incisions into the rectus fascia sheath were proposed.

Already recommended by Anton Wölfler (1850-1917) in 1892, Halsted popularized this procedure, which was later adapted by Norman Tanner (1906-1982) by 'sliding' part of the rectus sheath lateral and downwards to Poupart's ligament, and so reinforcing the Bassini-type of hernia repair.

Another idea to diminish tension on the muscular closure was invented by the German Martin Kirschner (1879-1942), who for the first time used autologous material, namely pedicled or free fascia from the thigh to bridge the inguinal muscular defect⁸⁸.

The idea of free fascia lata grafts was taken over by William Gallie (1882-1959) & Arthur Lemesurier (1889-1982), who used them as tension-free inlay on the weakened posterior inguinal wall⁸⁹. The technique was later popularized by Geoffrey Keynes (1887-1982).

However also non-autologous materials soon were used to bridge the posterior wall defect. Already in 1896 did Albert Narath (1864-1924) make use of silver filigree⁹⁰. Years later Francis Usher (1908-1980)⁹¹ (Fig.11) in 1958 used polypropylene as first successful synthetic prosthesis⁹².

The tension free concept got its breakthrough with Irving Lichtenstein (1920-2000) (Fig.12) from Los Angeles in the second edition of his well-known hernia monograph⁹³.

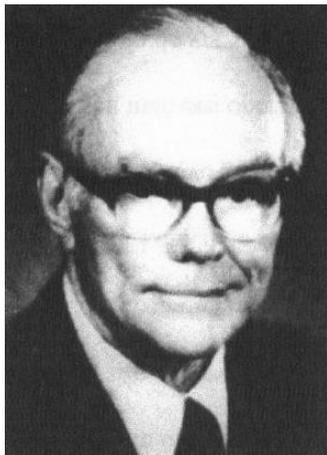


Fig. 11 *Francis Usher*

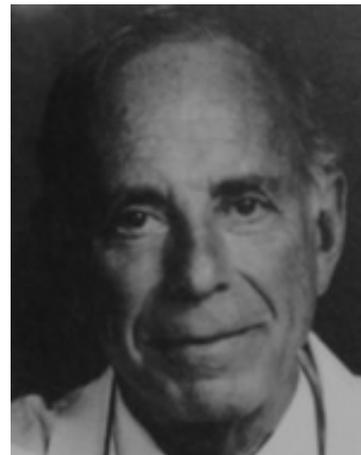


Fig. 12 *Irving Lichtenstein*

He realized a tension-free repair by using prosthetic material to bridge the gap between the muscular and ligament tissues. His technique equally used R/Marlex as prosthesis in a classical anterior inguinal approach⁹⁴.

⁸⁸ See Kirschner 1910.

⁸⁹ See Gallie & Lemesurier 1923.

⁹⁰ See Read 1994, p.3.

⁹¹ For a biography of Francis Cowgil Usher, see Read 1999. See also the internet article of the De Bakey Clinic: http://www.debakeydepartmentofsurgery.org/home/content.cfm_id=270.

⁹² The famous 'R/Marlex' mesh.

⁹³ See Lichtenstein 1970.

⁹⁴ See Lichtenstein 1964.

He reduced the intervention to an ambulatory operation. Lichtenstein's results proved so good⁹⁵ that it became up till now the standard evidence-based operation⁹⁶.

A variant of the Lichtenstein technique consisted via open incision of the pre- and retromuscular insertion of a double-sided prolene mesh, the so-called Prolene Hernia System (PHS)⁹⁷.

POSTERIOR INGUINAL APPROACH

The idea of repairing a groin hernia from the posterior side, in a preperitoneal position, was already suggested in the 18th century, namely in 1743⁹⁸. U.C.Bates (1875-?) in 1913 made analogous propositions⁹⁹.

However it got definitely accepted after the proposal of George La Roque (1976-1934) in 1919¹⁰⁰. He realized the approach by using an abdominal incision superior to the inguinal canal and, from within the peritoneal cavity, ligaturing the pulled back hernia sac. The technique was combined with a Bassini repair via the same cutaneous incision. Moreover opening the peritoneum allowed La Roque to inspect the bowel and other abdominal organs¹⁰¹. Arnold Henry (1886-1962) in 1936 was protagonist of an analogous approach, however via a lower abdominal midline incision¹⁰². Alas, both publications received too little attention. A totally extraperitoneal approach was first executed by Cheatle in 1920¹⁰³, as a radical operation for cure of both inguinal and femoral hernia via a lower mid abdominal preperitoneal approach, an incision he preferred for such cure over a Pfannenstiel incision.

Many authors, especially René Stoppa (1921-2006) (Fig.13) in France¹⁰⁴ reiterated this approach and acclaimed its advantages.



Fig. 13 René Stoppa at the congress of the European Hernia Society

⁹⁵ See Aytaç et al. 2004, who found a recurrence rate of 0.8% after Lichtenstein repair versus 4.1% after Shouldice repair. Equally Amid et al. found only 4 recurrences on 3250 patients in a 1 to 8 year follow-up from 1984 to 1992 (see Amid et al. p.185.).

⁹⁶ The tension free repair has now become the treatment of choice: see Macintyre 2003. Particularly the Lichtenstein repair is still the first recommended operation for inguinal hernia, not only in the Netherlands (see Simons et al., 2003), but also in many other countries. See the European Hernia Society guidelines (Simons et al., 2009).

⁹⁷ See Kingsnorth et al. 2002.

⁹⁸ Quoted by Richard Meade in 1965.

⁹⁹ See Bates 1913.

¹⁰⁰ For notes on La Roque's biography and techniques, see Rutkow 1993b pp. 397-398.

¹⁰¹ See La Roque 1919.

¹⁰² See Henry 1936.

¹⁰³ See Cheatle 1920.

¹⁰⁴ Stoppa popularized the procedure from 1973 onwards. See Stoppa 1973, Stoppa et al. 1984, and Stoppa & Van Hee 1998b.

They proposed the insertion of prosthetic material as used in the external approach, via the open preperitoneal approach.

The strengthening of the transversalis fascia with prosthetic material, be it via an external or internal approach, got boosted by new knowledge about the aetiology of direct inguinal hernias. A deficiency in collagen, resulting from impairment of proline and lysine hydroxylation proved to be the cause of weakening of this fascia, which remains the sole support of the posterior inguinal wall¹⁰⁵.

LAPAROSCOPIC APPROACH

With the advent of computer chip technology, laparoscopic visualisation and treatment of inguinal hernia got introduced in the surgical arena¹⁰⁶.

Ralph Ger was the first in 1982 to report a transabdominal closure of an inguinal hernia defect during a laparoscopy for other reasons¹⁰⁷. His technique consisted of transfixing with Michel staples the peritoneal hernia sac together with the surrounding tissues¹⁰⁸, thereby trying to prevent hernia recurrence. The good results incited Ger to continue on the same track, and to build up experience with experimental work on animals, now inserting the stapler device via a second separate laparoscopic trocar¹⁰⁹.

Some years later, in 1989, the gynaecologist S.Bogojavalensky¹¹⁰ showed a video demonstrating the laparoscopic intraabdominal incision of the peritoneal hernia sac, subsequently closing the visible muscular defect with a rolled-up piece of polypropylene mesh.

The early 1990's saw a rapid rise of the number of publications, confirming the feasibility of laparoscopic hernia repair¹¹¹.

Whereas the first interventions were confined to a plug and patch repair¹¹², later transabdominal approaches opted for the fixation of a large preperitoneal mesh, either sutured or stapled to the posterior muscular wall¹¹³.

A first attempt was made by applying a synthetic mesh to the peritoneal defective wall. It got the name IPOM (IntraPeritoneal Onlay Mesh).

Another approach consisted in making an intraperitoneal U-type incision in the peritoneal wall and inserting the mesh in a preperitoneal position. It became known as the TAPP technique (TransAbdominal PrePeritoneal approach).

Soon other surgeons proposed a complete extraperitoneal insertion of the preperitoneal mesh, namely Dulucq in 1992, Ferzli et al. in 1992, Himpens in 1992, and Barry Mac Kernan and Laws in 1993¹¹⁴. The technique was soon followed by many others. It became known as the TEP technique (Total ExtraPeritoneal approach). Even a special balloon dissector was introduced to facilitate this extraperitoneal approach¹¹⁵.

Several discussions and symposia followed the introduction of laparoscopic techniques in inguinal hernia repair¹¹⁶.

¹⁰⁵ See Wagh et al. 1974.

¹⁰⁶ See for a historical overview of these recent developments: José Cervantes 2004.

¹⁰⁷ See Ralph Ger 1982.

¹⁰⁸ Resembling what Franco had done from the outside in the 16th century!

¹⁰⁹ See Ger et al. 1990.

¹¹⁰ Video-presentation at the 18th Annual Meeting of the American Association of Gynaecological Laparoscopists in Washington D.C.

¹¹¹ The first reports were published by Leonard Schultz et al. in 1990, and J. Corbitt, Bob Fitzgibbons et al., and Frederick Toy and Smoot. in 1991 (and many other authors in the following years!),

¹¹² E.g. those of Schultz et al., and Corbitt.

¹¹³ See Morris Franklin 1992, Arregui et al. 1992, Himpens 1992, and others.

¹¹⁴ See Ferzli et al., 1992, Dulucq 1992, Himpens 1992, and McKernan & Laws, 1993.

¹¹⁵ See Kieturakis 1995.

¹¹⁶ See Van Hee 1998.

In the first place ethical issues were put forward¹¹⁷. Indeed, many surgeons worldwide had immediately started their laparoscopic experience on patients, in contrast to various other techniques in surgical practice, where animal experiments precede evaluation in humans.

Moreover in an era where trials were in common use for new drugs, instruments or techniques, trials in laparoscopy on the contrary were performed scarcely and late, and yielded results only years after the already liberal use of laparoscopy.

When the first trials with often small numbers of patients were published, no real differences in outcome were observed between standard Shouldice or Lichtenstein repairs and laparoscopic techniques¹¹⁸. Neither was there at first significant difference between the TAPP and TEP forms of laparoscopic repair¹¹⁹.

However in all trials reduced pain, as well as earlier ambulation and return to work became strongly apparent¹²⁰. These advantages had to counteract the soon observed higher risk of nerve lesion, resulting in so-called meralgia paresthetica¹²¹, and the higher financial costs of the use of laparoscopic apparatus.

In a later stage, many surgeons favoured the extraperitoneal TEP approach, in view of the absence of adhesion risks in the abdomen¹²².

However, both TAPP and TEP techniques continued to be used in the last 15 years, and are advised as evidence based techniques, equal to Lichtenstein repair¹²³.

A second series of discussions focussed on technical aspects of laparoscopic repair. So were surgeons concerned about the optimal size¹²⁴ or structure of the mesh¹²⁵, or tried newer forms of cameras, trocars or instruments.

As it stands now, as well open techniques with tension free repair (type Lichtenstein repair), as laparoscopic techniques with preperitoneal mesh placement (type TAPP or TEP) are the evidence-based and accepted methods in use to deal with adult inguinal hernia¹²⁶.

It will be interesting to evaluate how these actual types of hernia repair evolve in the future.

CONCLUSION

Inguinal hernia repair has made enormous progress throughout the ages. The main reasons for intervention however remained the same: continuous growth of the inguinal and/or scrotal swelling, the risk of incarceration of the hernia content and the bad results of conservative methods like truss placement.

Surgical techniques have rapidly evolved since Eduardo Bassini proposed his first successful reconstruction of the inguinal floor.

The various adaptations of his technique did however not result in a substantial reduction in the number of recurrences.

The tension free repair, introduced by Irving Lichtenstein, caused a dramatic drop in the recurrence rate and became the procedure of choice.

¹¹⁷ See Van Hee 1994.

¹¹⁸ See Barkun et al 1995, Juul & Christensen 1999.

¹¹⁹ See Van der Schelling et al 1996; Van Hee et al. 1998b.

¹²⁰ See Wall et al. 2008.

¹²¹ See Kraus 1993.

¹²² See Himpens et al. 1994.

¹²³ See The European Hernia Society guidelines: Simons et al. 2009.

¹²⁴ See Knook et al. 2001 and Totté et al. 2005.

¹²⁵ See for an overview of the history of different mesh types: James DeBord 2005.

¹²⁶ See Van Hee 2007.

Since the introduction of laparoscopic techniques, these methods became equally accepted for inguinal hernia, in particular in western regions where financial aspects play a less prominent role.

The future will tell how hernia repair will evolve in the next decades.

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