Hernia (2010) 14:143–148
DOI 10.1007/s10029-009-0578-y

ORIGINAL ARTICLE

Inguinal hernia surgery in the Netherlands: are patients treated according to the guidelines?

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Received: 4 June 2009 / Accepted: 9 October 2009 / Published online: 2 November 2009

Abstract
Purpose In 2003, a dedicated Dutch committee developed evidence-based guidelines for the treatment of inguinal hernia (IH) in children and adults. The aim of this study was to describe trends in hernia care before and after the publication of the guidelines on IH surgery in the Netherlands.
Methods Originally, a retrospective baseline analysis of IH surgery in 90 Dutch hospitals was performed among patients treated for IH in 2001. The results of this baseline analysis were compared with a recently performed second analysis of patients treated for IH in 2005.
Results In children <4 years of age, the study showed a significant decrease of contralateral explorations. In adults, the study showed that significantly more patients were treated with a mesh-based repair in 2005 (95.9 vs. 78.8%, $P < 0.01$). Moreover, there was an increase of patients with bilateral hernia treated with an endoscopic technique (41.5 vs. 22.3%, $P < 0.01$) and more patients were treated in day surgery (53.5 vs. 38.6%, $P < 0.01$). Lastly, a decline in operations performed for recurrent IH in adults was observed (10.9 vs. 13.3%, $P < 0.01$).
Conclusion This study showed that most patients with IH in the Netherlands were treated according to the main recommendations of the Dutch evidence-based guidelines.

Keywords Inguinal hernia · Guidelines · Recurrence · Mesh · Techniques

Abbreviation
IH Inguinal hernia

Introduction

In 2003, a Dutch committee developed evidence-based guidelines for the treatment of inguinal hernia (IH) in children and adults [1]. The guidelines for adults are mainly based on systematic reviews of randomised controlled trials (RCTs) with consistent results from individual (homogenous) studies, thus, creating level 1a evidence. In the guidelines for children, the level of evidence was 2b; RCTs of poorer quality or cohort or case–control studies. The main recommendations of these guidelines for children were first to perform a hernial sac resection with high

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ligation of the hernial sac, and second that contralateral exploration is not to be performed on a routine basis.

The main recommendations of the guidelines for adults were to use a mesh-based repair technique in adult patients (level 1a), preferably in day surgery (level 2b), and to consider local anaesthesia when performing open anterior repair (level 2c). For primary unilateral IH, the guidelines recommend a Lichtenstein repair technique (level 4). For recurrences after an anterior repair and bilateral hernia, an endoscopic repair technique is recommended, performed by a trained team (level 4). The guidelines, furthermore, consist of 20 chapters with recommendations on all aspects of IH treatment, from diagnosis to aftercare.

It was expected that the guidelines would improve the quality, efficiency and transparency of IH treatment [1]. To evaluate the implementation of these guidelines, published in 2002, a baseline analysis of IH surgery was performed among patients treated for IH in 2001 [2]. The results of this baseline analysis were compared with a second analysis of patients treated for IH in 2005, in order to describe trends in hernia care before and after the publication of the guidelines on IH surgery in the Netherlands. It was of primary interest to evaluate whether more patients with IH had been treated according to the main recommendations after the introduction of the guidelines. The secondary goal was to determine whether the recommendations had an effect on the percentage of operations performed for recurrences and other aspects, such as the frequency of ambulatory care surgery, type of anaesthesia, level of surgical expertise and complications.

Methods

To evaluate the implementation of the guidelines, a baseline study before their introduction had to be performed. A second study after the implementation could then serve as a comparison with the first study.

Consequently, a retrospective study was performed among patients treated for IH in the Netherlands in the period January–March 2001 [2]. The results of this study were used as the baseline values in comparison to the results of a second retrospective study of IH repairs performed over the period January–March 2005. The first retrospective data collection was performed in 2003 and the second data collection in 2007. Therefore, all patients had been operated upon at least a year prior to the data collection. In both studies, the exact same study design with original patient and operation charts was applied. For the first study, all Dutch hospitals ($n = 130$) were asked to participate. Of these 130 hospitals, 90 (69%) hospitals (52/72 teaching hospitals and 38/58 non teaching hospitals) participated. The 90 hospitals that had participated in the first analysis were all revisited. The following data were recorded: age, type of hospital (academic centre, teaching hospital or non-teaching hospital), admission or day surgery, operation for primary or recurrent hernia and previously used operation technique, unilateral or bilateral hernia, number of years after previous repair (in recurrent hernia), acute versus elective surgery, and the number and type of complications. The operation technique, the type of hernia and the type of anaesthesia were retrieved from the operation reports. Patients with bilateral hernia were evaluated as two separate hernias. Children (<18 years of age) and adults (≥18 years of age) were analysed separately.

Although the treatment of femoral hernias and IH can be similar, patients with femoral hernias were excluded from this study because of differences in pathology and incidence. In addition, the treatment of femoral hernias was not integrated in the guidelines.

Statistical analysis

Data were expressed as mean ± standard deviation (SD). Proportions were compared using Chi-square analysis with Yates' correction. For all tests, a P-value <0.05 was considered to be significant.

Results

The study resulted in a total of 4,354 IH in 3,954 patients (children and adults) in 2001 and 5,374 IH in 4,846 patients in 2005.

Children

General findings

A total of 741 hernias in 691 children were operated in 2001, compared to 744 hernias in 696 children in 2005.

The patient, hernia and surgical characteristics are outlined in Table 1.

Operating techniques in children

Hernial sac resection in 2001 and 2005 was performed in 713 (96.2%) and 711 (95.6%) cases, respectively. In three cases (one patient with a bilateral hernia) in 2005, a hernial sac resection was performed using a laparoscopic technique. This was performed extraperitoneally in two patients and transabdominally in one patient. A hernioplasty (Bassini and Shouldice technique) was performed in 15 (2.1%) cases in 2001 and seven cases (0.9%) in 2005.

Mesh techniques were used in six (0.8%) cases in 2001 and 23 (3.1%) cases in 2005. In 2001 and 2005, the Lichtenstein technique was used in three (0.4%) and ten

Table 1 Patient, hernia and surgical characteristics of inguinal hernia (IH) operations performed in children (<18 years of age) in 90 hospitals in the Netherlands from January to March in 2001 and in 2005

	2001 *N* (%) 691 children 741 IH	2005 *N* (%) 696 children 744 IH	*P*-value
Sex			
Male	535 (77.4)	505 (72.6)	0.042
Female	156 (22.6)	191 (27.4)	0.042
Location			
Right	414 (59.9)	414 (59.5)	0.781
Left	226 (32.7)	232 (33.3)	0.781
Bilateral	51 (7.4)	50 (7.2)	0.946
Type of hernia			
Indirect	558 (97)	716 (98.1)	0.701
Direct	12 (2.1)	12 (1.6)	0.997
Combined	5 (0.9)	2 (0.3)	0.255
Not specified in chart	166	14	
Recurrent hernia	21 (2.8)	17 (2.3)	0.492
Day surgery	566 (81.4)	594 (85.3)	0.06
Anaesthesia			
General anaesthesia	508 (88.0)	584 (92.4)	<0.01
General anaesthesia and caudal block	60 (10.4)	42 (6.6)	0.055
Spinal	9 (1.6)	6 (1.0)	0.421
Not specified in chart	114	64	
Level of surgeon (only teaching hospitals)			
Surgeon	124 (30.4)	125 (26.2)	0.202
Surgeon + resident	109 (26.9)	126 (26.4)	0.824
Resident + surgeon	163 (40.2)	211 (44.1)	0.275
Resident alone	10 (2.5)	16 (3.4)	0.436

(1.3%) cases, respectively. The mean age of patients receiving a mesh repair was 15.4 years (range 12.0–17.8) in 2001 and 17.2 years (range 16.58–17.7) in 2005.

Acute or semi-acute surgery for strangulated or incarcerated hernia was performed in 44 (5.9%) patients in 2001 and 38 (5.1%) patients in 2005.

In children younger than 4 years of age, a contralateral exploration was performed in 45/404 (11.1%) children in 2001 and this decreased to 4/400 (1%) in 2005 ($P < 0.01$).

Complications

Complications were registered in 2001 and 2005 in 44 (5.9%) and 28 (3.8%) patients, respectively. In 13 (1.8%) patients in 2001 and ten (1.3%) patients in 2005, recurrences were reported within 12 months. All children in 2001 and nine in 2005 underwent a second operation.

Haematoma or seroma were reported in 12 (1.6%) cases in 2001 and seven (0.9%) cases in 2005. In 2001 one (0.1%) child and in 2005 four (0.5%) children suffered from postoperative bleeding, which resulted in reexploration in three cases.

There were 12 (1.8%) reports of pain in 2001; two of these patients suffered from chronic pain (one neuralgic, one somatic). In 2005, pain was reported in three (0.4%) patients, one of whom suffered from chronic pain (somatic). Both in 2001 and in 2005, two (0.3%) patients were reported to have developed wound infections.

Adults

General findings

A total of 3,613 hernia repairs in 3,263 patients were performed in 2001. In 2005, this was 4,630 and 4,150, respectively.

The patient, hernia and surgical characteristics are outlined in Table 2.

Operating techniques in adults

A mesh-based repair in 2001 and 2005 was performed in 2,847 (78.8%) and 4,442 (95.9%) IH operations, respectively.

Table 2 Patient, hernia and surgical characteristics of IH operations performed in adults (> 18 years of age) in 90 hospitals in the Netherlands from January to March in 2001 and in 2005

	2001 *N* (%) 3,263 adults 3,613 IH	2005 *N* (%) 4,150 adults 4,630 IH	*P*-value
Sex			
Male	3,077 (95.4)	3,859 (94.3)	0.038
Location			
Right	1,516 (46.5)	1,966 (47.4)	0.166
Left	1,397 (42.8)	1,704 (41.0)	0.184
Bilateral	350 (10.7)	480 (11.6)	0.793
Type of hernia			
Indirect	1,543 (48.1)	2,113 (49.0)	0.440
Direct	1,380 (43.0)	1,828 (42.4)	0.586
Combined	284 (8.9)	370 (8.6)	0.687
Not specified in chart	406	319	
Recurrent hernia	481 (13.3)	507 (10.9)	<0.01
Day surgery	1,252 (38.6)	2,219 (53.5)	<0.01
Anaesthesia			
General anaesthesia	1,302 (53.0)	1,900 (55.1)	0.097
Spinal	977 (39.7)	1,496 (43.4)	<0.01
Local	179 (7.3)	54 (1.5)	<0.01
Not specified in chart	805	700	
Level of surgeon (only teaching hospitals)			
Surgeon	349 (21.7)	453 (17.3)	<0.01
Surgeon + resident	348 (21.6)	592 (22.6)	0.466
Resident + surgeon	649 (40.3)	1,120 (42.7)	0.125
Resident alone	265 (16.4)	459 (17.4)	0.381

The IH repair techniques used in both periods are shown in Table 3.

As shown in Table 3, a significant increase was found in the use of mesh techniques ($P < 0.01$). The Lichtenstein technique was the most often used technique both in 2001 and 2005, with a significant increase of 17.8% (from 40.2 to 58.0%) in 2005 ($P < 0.01$).

As for patients with bilateral hernia, endoscopic techniques were performed in 78 of 350 (22.3%) patients in 2001 and in 199 of 480 (41.5%) patients in 2005 ($P < 0.01$).

In both years, endoscopic techniques were performed more frequently in bilateral compared to unilateral hernias. In 2001, 13.4% (485 of 3,613) of all patients underwent an endoscopic technique compared to 22.3% (78 of 350) for bilateral hernias. In 2005, this was 18.5% (857 of 4,630) and 41.5% (199 of 480), respectively. In the case of recurrent IH, after an anterior repair, 90 (18.9%) and 116 (22.9%) patients in 2001 and 2005, respectively, were treated endoscopically ($P = 0.126$).

A total number of 71 (2.0%) and 82 (1.8%) patients underwent acute surgery for strangulated or incarcerated hernia in 2001 and 2005, respectively.

The average duration of hospitalisation in 2001 was 2.1 ± 2.0 days (range 1–40). In 2005, this was 1.8 ± 1.6 days (range 1–21).

Complications

One or more complications were registered in 499 (15.3%) patients in 2001 and 562 (13.5%) patients in 2005. The baseline analysis of the 2001 cohort reported (early) recurrences in 69 patients (1.9%). The recurrence rate of the second analysis was also 1.9% (88 patients).

Chronic pain (>3 months) was reported in 62 patients (1.7%) versus 95 patients (2.1%) in 2001 and 2005, respectively.

In both analyses, the majority of complications consisted of postoperative haematoma or seroma; 417 patients (11.5%) in 2001 and 375 patients (8.1%) in 2005.

Discussion

This study demonstrates that improvements have been made in the treatment of IH. Different factors can be responsible

Table 3 The IH repair techniques in adults (>18 years of age) performed in 90 hospitals in the Netherlands from January to March in 2001 and in 2005

	2001 *N* (%)	2005 *N* (%)	*P*-value
Mesh repair	2,847 (78.8)	4,445 (95.9)	<0.01
Lichtenstein	1,451 (40.2)	2,686 (58.0)	<0.01
Endoscopic	485 (13.4)	857 (18.5)	<0.01
TEP	429 (11.9)	764 (16.5)	<0.01
TAPP	56 (1.5)	93 (2.0)	0.104
Plug and patch	276 (7.6)	335 (7.2)	0.488
Lichtenstein and plug	147 (4.1)	39 (0.8)	<0.01
Grid iron	168 (4.6)	100 (2.2)	<0.01
Stoppa	110 (3.1)	76 (1.6)	<0.01
Prolene Hernia System	62 (1.7)	179 (3.9)	<0.01
Other	148 (0.1)	170 (3.7)	
Non-mesh repair	766 (21.2)	188 (4.1)	<0.01
Shouldice	310 (8.6)	17 (0.4)	<0.01
Bassini and variations	228 (6.3)	62 (1.4)	<0.01
Herniotomy	142 (3.9)	56 (1.2)	<0.01
Other	86 (2.4)	53 (1.1)	

TEP total extraperitoneal hernia repair; *TAPP* transabdominal preperitoneal; *Grid iron* technique covering the myopectineal orifice of Fruchaud with a non-absorbable prosthesis in the pre-peritoneal space

for changes in surgeons' practice. Besides the introduction of the Dutch guidelines, attending scientific meetings, courses or reading literature, especially systematic reviews, can lead to changes in practice. The guidelines were well advertised and sent to each surgeon in hard copy. Various symposia were organised on this topic at the meeting of the Dutch Surgical Society. One drawback of this study is the retrospective character of the data, which may have caused bias in some aspects, which require further discussion.

Children

Few significant changes had occurred in IH surgery in children after the introduction of the guidelines. The majority of patients were being treated according to the guidelines; by hernial sac resection in day surgery under general anaesthesia. Laparoscopy in pediatric IH has been introduced in the Netherlands. Three patients were treated with an endoscopic procedure. Although the role of laparoscopic treatment of IH in children remains unclear, it may have its advantages in contralateral IH. The laparoscopic technique enables diagnosing a femoral hernia accompanied by an IH (preventing a pseudo recurrence). In addition, laparoscopic treatment results in a reduced operation time [3, 4].

A remarkable fact was the high incidence of patients treated for a recurrence within 1 year of follow-up in both analyses (2001 1.8%, 2005 1.3%). The relatively high percentages of early recurrences compared to the rate of 0.5–1% reported in the literature [5] should be considered as technical failures based on inadequate sac resection. There may have been recurrences in patients with insufficient internal rings, who should have undergone a hernioplasty.

The Dutch guidelines recommend that contralateral exploration should not be performed routinely, but can be considered in patients with a high risk of double-sided hernia, high risk of strangulation or a high risk of general anaesthesia (pre-matures) [1]. In 2005, the number of patients ≤4 years of age undergoing contralateral exploration had significantly decreased (11.1 vs. 1%, $P < 0.01$).

Adults

During the study period, the use of mesh-based operation techniques significantly increased by more than 17% to 95.9% in 2005.

In addition, a significant increase in the use of endoscopic repairs for bilateral hernia was noted. In 2005, 41.5% of patients with bilateral hernias were treated according to the guidelines. Endoscopic techniques were performed more frequently in bilateral compared to unilateral hernia.

The upcoming of dedicated hernia centres and increased attention for IH surgery in the Netherlands during the past few years might have contributed to a higher volume of endoscopic repairs in the Netherlands.

The Dutch guidelines have stated that IH surgery in day surgery is as safe and effective as an inpatient setting, and is also more cost-effective [1]. Furthermore, IH surgery can be easily performed in day surgery, irrespective of the technique used [6, 7]. In accordance with these recommendations, a significant increase of patients treated in day surgery was found during the surveillance period ($P < 0.01$).

Open anterior IH techniques can be satisfactorily performed under local anaesthetic [8, 9]. The reduction of costs and a quicker return to normal activity in unilateral reducible IH are important factors [10]. The guidelines, therefore, recommend in the case of an open repair to consider local anaesthesia for all adult patients with a primary reducible unilateral IH [1]. Despite this recommendation, the study showed a significant decrease in the use of local anaesthetic ($P < 0.01$). This could be explained by unfamiliarity with the technique and insufficient training. Furthermore, improved safety and tolerability of general anaesthesia make local anaesthetic less appealing.

During the studied period (2001–2005), a significant decrease of operations performed for recurrences was

shown ($P < 0.01$). Comparable results were found in a study concerning an Amsterdam teaching hospital [11]. This may possibly imply that the total number of recurrences is also decreasing. The increase of mesh-based techniques according to the Dutch evidence-based guidelines could provide an explanation. Furthermore, emphasis on IH surgery and training might have contributed to improved results [12, 13]. It has to be taken into account that the significant decrease only reflects operated recurrent hernias, as many patients with asymptomatic recurrences may not undergo repeated surgery. Although the recommendation of the guidelines was to consider the use of an endoscopic repair technique for recurrences after an anterior repair, only 22.9% of patients were treated accordingly.

Complications were not registered prospectively. The results should, therefore, be interpreted with caution. Early recurrence (<1 year) in 2005, as in 2001, was reported in 1.9% of patients. These are almost certainly caused by incorrect or inadequate operation technique, or a missed hernial sac, which, apparently, cannot be corrected with the use of mesh.

Currently, postoperative inguinal pain is a major endpoint. In this study, chronic pain was reported in 1.7% (2001) and 2.1% (2005) of patients. These percentages should be considered as underestimations due to the limitations of the retrospective study design since, in the literature overall, moderate to severe pain has been reported by 10–12% of patients [14, 15].

Conclusions

This study showed that most patients with inguinal hernia (IH) in the Netherlands were treated according to the main recommendations of the Dutch evidence-based guidelines. There was a significant increase in the use of mesh-based repairs, especially the Lichtenstein technique. Furthermore, a significant increase of patients treated in day surgery and an increase of patients with bilateral hernia treated with endoscopic techniques were shown.

Due to the character of the study, it is not possible to assess the exact effect of the introduction of the guidelines versus the ongoing developments in the literature and research on IH surgery.

Acknowledgments The authors would like to thank all of the participating hospitals.

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