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Inguinal hernia surgery in The Netherlands: a baseline study before the introduction of the Dutch Guidelines

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Abstract Background: In 2003 the Dutch Guidelines for treatment of inguinal hernia (IH) were published. For treatment of IH in adults, the evidence-based guidelines recommend the use of a mesh repair technique. In order to be able to evaluate the effects of these guidelines, a baseline analysis of inguinal hernia surgery before the introduction of these guidelines had to be performed. The second analysis will be performed two years (January–March 2005) after the publication of the Guidelines. Objective: To make an inventory of IH surgery in the Netherlands, before the introduction of guidelines for IH treatment, to serve as a baseline for future evaluation of the impact of the implementation of these guidelines. Methods: A retrospective descriptive study was performed in 2003 using patient and operation charts including IH repairs performed in The Netherlands over a three-month period (January–March 2001). Results: 97/133 (73%) hospitals cooperated with the study, generating data from a total of 4386 IH in 3979 patients (3284 adults, 695 children). Mesh techniques were used in 2839 (78%) adult inguinal hernias while 800 (22%) patients were treated with non-mesh techniques. 484 (14.7%) adult patients were operated on during the study period for a recurrent hernia from previous years. Early recurrence (<1 year) occurred in 2.2% of all pa-

tients. Wound infection was documented in 0.8% of all IH. The mortality rate was 0.1%. 1257 of the 3284 (38.3%) adults, and 566 of the 695 children (81.4%), were operated on in ambulatory care. Conclusions: In the episode prior to implementation of the Dutch evidence-based Guidelines for treatment of inguinal hernia, 2839 (78%) adult patients were treated with mesh repair and 484 (13.3%) patients were treated for a recurrent hernia.

Keywords Inguinal hernia · Inventory · Guidelines · Techniques · Mesh

Introduction

In 2003 a Dutch committee developed evidence-based guidelines for the treatment of inguinal hernia (IH) in children and adults [1, 2]. The main recommendations of the guidelines were to use a mesh-based repair technique in adult patients, preferably in day surgery, and to consider local anaesthesia when performing open anterior repair. For primary one-sided IH, the Guidelines recommend a Lichtenstein repair technique. For recurrences after an anterior repair and bilateral hernia, an endoscopic repair technique is recommended, provided a trained team is available. The Guidelines furthermore consist of 20 chapters with recommendations concerning all aspects of IH surgery from diagnosis to postoperative treatment.

It is expected that the Guidelines will improve quality, efficiency and transparency in IH surgery [1, 2]. To be able to evaluate the implementation of these Guidelines, a baseline analysis of IH surgery was performed. The results of this baseline analysis are to be compared with a second analysis that will take place in 2005, in order to establish a possible effect of the implementation of the guidelines on IH surgery in the Netherlands. Increased use of mesh technique will hopefully result in a decrease in recurrence operations.

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The goal of this study was to set a baseline analysis and at the same time to perform an inventory of IH surgery in the Netherlands. It was of primary interest to assess the operating techniques and the percentage of operations performed for recurrences. The secondary goal was to make an inventory of other aspects, like frequency of ambulatory care surgery, type of anaesthesia, level of surgical expertise, and complications.

Patients and methods

A retrospective descriptive study of IH repairs performed in The Netherlands in the period January–March 2001 was performed. All patients had been operated on at least a year prior to the data collection. All Dutch hospitals (133) were asked to participate, and if they agreed (97), to provide data on all patients operated on in the study period. Various hospital registration systems were used to identify all of the patients (derived from all performed operative procedures). All data was retrieved from on-site visits in 2003 with original patient and operation charts by one of the authors (DL, TA, MR).

The following data were obtained; age, type of hospital (academic centres, teaching hospitals and non-teaching hospitals), admission or day surgery, operation for primary or recurrent hernia with previous operation technique, unilateral/bilateral hernia, the number of years after previous repair (in recurrent hernia), acute versus elective surgery, and the number and type of complications. The type of hernia, the operation technique, the expertise of the surgeon, and the type of anaesthesia were obtained from the operation report. Patients with a bilateral hernia were evaluated as two separate hernias in two different patients. Children (< 18 years) and adults (≥ 18 years) were analysed separately. Femoral hernias were excluded from this inventory.

The numbers involving surgeons or residents performing the operation are solely based on the data from (academic and district) teaching hospitals (43/97 participating hospitals).

Statistical analysis

Data were expressed as mean \pm standard deviation (SD). Comparison of data was performed using the Student *t*-test for paired and unpaired data when appropriate. Proportions were compared using chi-square analysis with Yates' correction. For all tests, a *P*-value < 0.05 was considered significant.

Results

The study included 97 of the 133 (73%) hospitals in The Netherlands in 2001 (6/8 academic centres, 37/46 teaching hospitals and 54/79 non-teaching hospitals).

This resulted in a total of 4386 IH in 3979 patients (3284 adults, 695 children). The mean age of the adults was 57.6 years (range 18.5–96.5), and of the children 4.2 years (range 0.1–17.9).

Children (< 18 years)

General findings

695 children were operated on, with a total of 747 hernias. 566 children (81.4%) underwent their operation in day surgery, 136 (18.2%) of the operations were performed in a paediatric hospital. The patient, hernia and surgical characteristics are outlined in Table 1.

Operating techniques

Hernia sac resection was performed in 719 (96.3%) of the cases. The Bassini and Shouldice techniques were used in ten and six cases respectively (total 2.1%). In five (0.7%) patients a mesh technique was used (Lichtenstein (three), Grid Iron (one) and a plug (one)); the mean age in these patients was 15.6 years (12.9–17.7), and these comprised three direct and two indirect hernias. The technique was unknown or data were missing in seven cases (0.9%).

35 (4.7%) of the patients underwent acute or semi-acute surgery for strangulated or incarcerated hernia. A contralateral exploration was performed in 45/410 (10.9%) children (≤ 4 years). In clinics with paediatric surgeons this percentage was 38.5% (37/96). The mean age of these children was 0.7 years (0.1–3.9).

Table 1 Patient hernia and surgical characteristics in 695 children with 747 inguinal hernias

	<i>N</i>	%
Sex (male)	541	77.8
Location		
Right	416	55.7
Left	227	30.4
Bilateral	52	13.9
Type of hernia		
Indirect	560	96.8
Direct	13	2.4
Combined	5	0.8
Not specified in chart	169	
Recurrent hernia	21	2.8
Day surgery	566	81.4
Anaesthesia		
General anaesthesia	545	87.0
General anaesthesia and caudal block	65	10.5
Spinal	11	1.8
Not specified in chart	126	
Surgeons (only teaching hospitals <i>n</i> = 405)		
Surgeon alone	123	30.4
Surgeon + resident	109	26.9
Resident + surgeon	163	40.2
Resident alone	10	2.5

Complications

44 (5.9%) complications were registered. 14 (1.9%) patients were found to have a recurrence within 12 months, all after hernia sac resection. They all underwent a second operation within twelve months. Haematoma/seroma occurred in 12 cases (1.6%). There were 13 (1.7%) reports of pain, and the pain lasted longer than three months in two of these patients (0.3%). Two patients (0.3%) had a wound infection, and in one case (0.1%) there was postoperative bleeding which did not need another operation.

Adults (≥ 18 years)

General findings

A total of 3639 hernia repairs in 3284 patients were performed. 2017 of the 3639 (55.4%) repairs were performed in non-teaching hospitals and 1622 of the 3639 (44.6%) in teaching hospitals (including academic centres). The patient, hernia and surgical characteristics are outlined in Table 2.

Operating techniques

The IH repair techniques used are displayed in Table 3. In 2839 (78.0%) of all IH operations a mesh repair technique was used and in 800 (22.0%) a conventional (non-mesh) technique; 86.2% of patients with a recur-

Table 2 Patient, hernia and surgical characteristics in 3284 patients with 3639 inguinal hernias

	N	%
Sex (male)	3137	95.5
Location		
Left	1395	42.6
Right	1521	46.5
Bilateral	355	10.9
Type of hernia		
Indirect	1553	48.1
Direct	1395	43.1
Combined	285	8.8
Not specified in chart	406	
Recurrent hernia	484	13.3
First recurrence	395	81.6
> 1 recurrence	89	18.4
Day surgery	1257	38.3
Surgeons (only teaching hospitals in surgery $n = 1680$)		
Surgeon alone	349	20.8
Surgeon + resident	348	20.7
Resident + surgeon	648	38.6
Resident alone	335	19.9
Anaesthesia		
General anaesthesia	1484	54.3
Spinal	1062	38.8
Local	188	6.9
Not specified in chart	905	

Table 3 Repair techniques used in 3284 adult patients with 3639 inguinal hernias, divided into 3155 primary and 484 recurrent inguinal hernias

	N = 3155		N = 484	
	Primary	%	Recurrent	%
Mesh repair				
Lichtenstein	1244	39.4	201	41.5
Endoscopic	395	12.5	91	18.8
TEP	356	11.3	74	15.3
TAPP	39	1.2	17	3.5
Plug and Patch	250	7.9	37	7.6
Lichtenstein and plug	160	5.1	23	4.8
Ugahary (gr'id iron)	153	4.8	15	3.1
Stoppa	78	2.5	34	7.0
Other	142	4.5	16	3.3
Non-mesh repair				
Shouldice	302	9.6	12	2.5
Bassini and variations	243	7.7	20	4.1
Herniotomy	120	3.8	23	4.8
Other	68	2.2	12	2.5

rent IH were operated on using a mesh repair technique this time.

In teaching hospitals (including academic centres), more hernias (1350/1622, 83.2%) were treated with mesh than in non-teaching hospitals (1481/2017, 73.4%, $p < 0.01$). Endoscopic repair techniques were performed more frequently in teaching hospitals (303/1622, 18.7%) than in non-teaching hospitals (182/2017, 9.0%, $p < 0.01$).

Of the 355 patients (710 hernias) with a bilateral hernia, 621 (87.5%) were treated with a mesh technique and 89 (12.5%) without the use of mesh techniques. 79 patients with bilateral hernias (158 hernias, 22.3%) underwent endoscopic repair. In Bilateral hernias an endoscopic repair technique 158/710 (22.3%) was used more often than in unilateral hernias 323/710 (11%), $p < 0.01$. 71 (2.0%) patients underwent acute surgery for strangulated or incarcerated hernia.

The previous technique used in recurrent IH is outlined in Table 4. The interval between the last IH operation and the operated recurrence is reported in Table 5. In patients operated on for recurrence, 42% had undergone the prior operation more than ten years ago. Admitted adult patients were older than patients treated in day surgery; 60.7 ± 16 years versus 52.2 ± 15 years ($p < 0.01$). The average duration of hospitalisation was 1.7 ± 1.7 days (1–40).

Complications

In 813 (22.3%) cases, one or more (total 916) complications occurred during or after operation, as shown in Table 6. Four patients died during hospital admission (bowel perforation after Lichtenstein, bladder perforation after Lichtenstein, bronchospasm after Stoppa and a cardiac arrest one day post-surgery after Lichtenstein). 111 (3.4%) patients underwent a re-operation: 74 (2.2%) because of a recurrence (within one year), 22 (0.7%) because of hematoma, seven (0.2%) because of neural-

Table 4 Preceding techniques in 484 adults with recurrent hernia

Technique	N=484	N(%) of patients with recurrence within five years after prior operation
Mesh		
Lichtenstein	33	31 (94)
TEP	13	9 (69)
TAPP	3	2 (67)
Ugahary (grid iron)	13	9 (69)
Preperitoneal	13	10 (77)
Plug and Patch	3	3 (100)
Non-mesh		
Bassini and variations	118	39 (33)
Other conventional*	65	26 (40)
Shouldice	28	10 (36)
Not specified in chart (mesh and non-mesh)	195	

* Including herniotomy and other non-mesh techniques

Table 5 Time between inguinal hernia repair and recurrence in 484 patients with recurrent hernia

Time to recurrence	N	% of total recurrences
< 2 years	100	20.7
2–5 years	73	15.1
5–10 years	100	20.7
> 10 years	202	41.7
Not specified in chart	9	1.8

gia, three (0.1%) because of a wound infection, and five (0.2%) for other reasons. In one patient with a deep infection, the mesh was removed. The three bowel perforations originated after respectively a TEP, a Lichtenstein and a PHS repair technique.

Discussion

The present study of 4386 inguinal hernia repairs in 3979 patients performed between January and March 2001 in The Netherlands will be used as baseline analysis to be able to evaluate the implementation of the Dutch Guidelines for inguinal hernia repair. This is the first

Table 6 Complications in 3284 patients after 3639 inguinal hernia repairs

Complication	N=916
Major	
Early recurrence	74 (2.0)
Pain > 3 months	62 (1.7)
Wound infection	32 (0.9)
Testicular atrophy	4 (0.1)
Bowel perforation	3 (0.08)
Mesh removal	1 (0.03)
Bladder perforation	1 (0.03)
Mortality	4 (0.1)
Minor	
Haematoma/seroma	421 (11.6)
Pain < 3 months	308 (8.5)
Urine retention	17 (0.5)
Wound dehiscence	3 (0.8)
Other	52 (1.4)

study evaluating the different techniques used for treatment of inguinal hernias in 73% of Dutch hospitals.

In the series of paediatric inguinal hernia the most remarkable and worrying fact was the high incidence of early recurrences. In univariate analysis, surgeon's experience, patients' age and type of hospital were no significant risk factors for early recurrence. However these recurrences should be considered as technical failures. There was no significant difference between the paediatric hospitals (1.5%) and the other hospitals (2.0%). The subject of contralateral exploration remains controversial [3]. In this study 10.9% of all children ≤ 4 years underwent a contralateral exploration. In paediatric clinics this percentage was much higher (38.5%). This is probably related to the higher prevalence of prematurely born or high-risk patients, and the low mean age (0.7 years, range 0.1–3.9).

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 (prematures, children with VP drainage), a high risk of strangulation, or a high risk of general anaesthesia (prematures) [1].

A wide variety of operating techniques were used in 3284 adult patients. A mesh-based technique was used in 78% of the operations. This percentage is in concordance with data reported from other countries [4, 5, 6]. Because the Guidelines recommend a mesh technique (preferably Lichtenstein) in all adults, it is assumed that there will be a decrease in the variety of techniques used and an increase in the number of operations performed with the use of a mesh technique.

In recent years many articles have discussed the treatment of inguinal hernia repair [7, 8, 9, 10]. One cannot expect that all surgeons are up-to-date with details from all studies, but it is remarkable to see that 7.2% of operations are still performed using the Bassini technique, which was demonstrated to be inferior to the Shouldice technique as far back as 1996 [11].

Furthermore, there is a significant difference in frequency of use of mesh techniques by teaching hospitals and non-teaching hospitals (83.5% versus 73.8%, $p < 0.01$). Moreover, the endoscopic techniques are also

performed more often in teaching hospitals (303/1602, 18.9%) than in non-teaching hospitals (182/1990, 9.1%), $p < 0.01$. This suggests, as one may expect, that more attention is paid to new developments in inguinal hernia treatment in teaching hospitals.

The guidelines recommend ambulatory care surgery for every patient, as it is as safe and effective as admission, but less expensive [12, 13]. The vast majority of patients in this study were still admitted into the hospital (63.6%). This is an opportunity for improvement. It has been shown in the literature that even a selected group of older patients and patients with ASA III can be operated on in ambulatory care surgery [14, 15, 16]. In some countries 80% of patients are treated on an ambulatory basis, which is probably related to reimbursement policies. In The Netherlands in 2001 there was no real incentive to perform an inguinal hernia repair in day-care due to reimbursement [17].

An important objective of the guidelines is to reduce the number of recurrences. The percentage of patients treated for recurrent hernia in this study is 13.3%. This is in line with data from Denmark, but higher than data from Scotland, countries in which comparable studies have been performed [4, 5]. It has to be taken into account that these percentages only reflect operated recurrent hernias, whereas many patients with asymptomatic recurrences may not have undergone surgery.

No technique is perfect, as demonstrated by the 78 patients with a recurrence after mesh repair. Since just how many patients per technique were at risk of recurrence is unknown, it is difficult to draw conclusions; however, it is a fact that recurrences occur with all techniques [18].

The Guidelines recommend that the use of local anaesthesia in patients with a primary unilateral hernia should be considered [1]. In this study, only 6.9% of the patients underwent surgery under local anaesthesia. In most cases this concerned patients with high comorbidity. The preference and the experience of the surgeon with local anaesthesia is an important factor in the decision to use local anaesthesia. Studies have shown no difference in economics and patient recovery after local or general anaesthesia [19].

Despite the fact that this was a retrospective study, with the risk of underestimation, the total percentage of complications was high (22.3%). The percentage of pain reports was 8.6% in the follow-up. 1.7% of patients suffered from pain after three months or more. These percentages are low compared to studies in which prospective questionnaires were used [20, 21], probably demonstrating the drawback of retrospective studies.

It is worrying that 2.2% of patients developed a recurrence within one year. No significant differences can be found in operational techniques, levels of surgical expertise, or the types of hospital between this and non-recurrent patients.

Surprisingly, two of the three reported bowel perforations were caused by an anterior technique. This only occurred in an endoscopic procedure once. Bladder

perforation occurred only once after a Lichtenstein procedure and never occurred after an endoscopic correction, even though this complication has been feared when performing this technique.

Despite the fact that the results may be subject to bias, as it is a retrospective analysis of patient charts, it generates a large amount of reliable information and good insights into the practice of inguinal hernia surgery in a recent period.

Conclusion

Before implementation of the Dutch evidence-based guidelines for treatment of inguinal hernia, 2839 (78%) adult patients were treated with mesh repair and 484 (13.3%) patients were treated for a recurrent hernia. Implementation of the evidence-based Guidelines for inguinal hernia will hopefully demonstrate an improvement in patient care, with more use of mesh techniques (resulting in a lower recurrence rate) and more use of day surgery and local anaesthesia (resulting in more cost-effectiveness and safety).

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