

# Hernia surgery in a defined population. Improvements possible in outcome and cost-effectiveness

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During 1992 operations for groin hernia in adults were prospectively recorded in eight hospitals with a total catchment area covering 761 000 inhabitants. An operation rate of 254 (147–478) operations per 100 000 inhabitants per year, mean and range for the eight hospitals, was observed. Seventeen per cent of all 1936 operations were done for recurrent hernias, range 10–21%. The Bassini repair and the Shouldice technique were used in 29 and 25% of the herniorrhaphies, respectively. A low but increasing use of laparoscopic surgery was noted. Four patients with a median age of 84 years died postoperatively. The rate of day surgery varied significantly between the hospitals, from 0–59%, mean 30%. A prospective registration of the present type allowing interhospital comparisons and serving as a basis for audit may be of value in improving outcome and cost-effectiveness in hernia surgery.

Key words: Hernia repair, surgery rate, audit

## Introduction

Herniorrhaphy is the most commonly performed operation on adult males in general surgery<sup>1</sup>. The outcome following groin hernia repair of experienced surgeons is well documented with recurrence rates around or below 1% using the Shouldice technique<sup>2–4</sup> or recently, tension-free repairs with prosthetic mesh<sup>5</sup>. Outside specialized units recurrence rates within the range 5–20% have been reported<sup>6,7</sup>, but information is scanty concerning type of operation used, fraction of patients treated within day surgery, as well as morbidity and patient satisfaction after operation. The present study was initiated in order to study management of groin hernias within a defined and fairly large population, thereby also establishing a basis for evaluation of long-term outcome.

## Methods

From 1 January to 31 December 1992 eight Swedish hospitals, seven located in the south-east region of Sweden and one further north recorded all hernia operations

on patients above the age of 15 years according to a common protocol. The population studied amounted to 761 000 inhabitants. The protocol covered data concerning patient characteristics including suitability for follow-up, time on waiting list, day surgery or nights spent in hospital, acute or elective surgery, information on operation (type of procedure, suture material, bowel resection, intraoperative complication, surgeon), anaesthesia, postoperative complication. Data from each hospital were stored in computerized form. After the end of the registration period statistical analyses were performed with the Quest program<sup>8</sup>.

## Definitions

Day surgery: In hospital stay less than 12 h.

Mean hospital stay: Number of nights in hospital for a group of patients studied divided by total number of patients within that group.

Postoperative death: Mortality within 30 days after operation.

## Statistics

Chi squared tests were used to test independence between parameters and difference between groups; *P* values stated are double-sided.

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**Table 1.** Inguinal and femoral hernia repair in relation to age and sex

Hernia type	Age (years)	Sex		Total n
		Male n	Female n	
Inguinal	15-24	52	5	57
	25-34	92	13	105
	35-44	158	13	171
	45-54	289	20	309
	55-64	380	14	394
	65-74	455	26	481
	75-84	274	40	314
	>85	39	3	42
Total		1738	134	1873
Femoral	15-34	0	3	3
	35-44	3	3	6
	45-54	4	6	10
	55-64	2	2	4
	65-74	9	12	21
	75-84	7	6	13
	85-94	1	5	6
Total		26	37	63

**Table 2.** Hernia type – primary and recurrent hernias

Hernia type	Primary		Recurrent		Total	
	n	%	n	%	n	Acute n
Direct	484	30.0	172	53.3	656	38
Indirect	870	53.9	89	27.6	959	41
Combined	137	8.5	21	6.5	158	5
Femoral	50	3.1	13	4.0	63	17
Sliding*	49	3.0	14	4.3	63	2
Others	23	1.4	14	4.3	38	2
Total	1613	100	323	100	1936	105

\*This group was used for sliding hernias not classified in any other group.

## Results

### *Incidence, type of hernia and reoperation rate*

In the participating hospitals 1936 operations for groin hernias were performed during 1992, giving an incidence rate of 254 per 100 000 inhabitants per year. The range of the rates for the eight hospitals were overall 147–478. During the first half of the year 1077 patients were treated, during the second half 859 patients. The age of the patients was 62 (49–72) years (median, upper and lower quartile). Age- and sex-specific operation rates are given in Table 1. Table 2 shows type of hernia for primary and recurrent hernias separately. As can be seen, 54% of the primary hernias were indirect and 30% direct, the corresponding figures for recurrent hernias being 28 and 53%, respectively. The overall reoperation rate was 17% (323 out of 1936 herniorrhaphies) with a variation between the hospitals from 10–21%, the inter-hospital difference failing to reach statistical significance ( $\chi^2 = 12.7, f = 7, P = 0.08$ ). In 105 cases the indication to operate was considered acute and six of eight bowel

**Table 3.** Type of operation

Technique	Repair n	%
Bassini	564	29.1
Shouldice	489	25.3
Other*	362	18.7
McVay	214	11.1
Marcy	153	7.9
Laparoscopy	88	4.5
Mesh	34	1.8
Nyhus	32	1.7
Total	1936	100

\*Repair not adequately described by other methods according to operating surgeon.

**Table 4.** Suture materials

Material	No.	%
Absorbable	506	26.1
Polyglycolic (Dexon®)		
Polyglactin 910 (Vicryl®)		
Slowly-absorbable	762	39.4
Polydioxanone (PDS®)		
GTMC (Maxon®)		
Non-absorbable	643	33.2
No information	25	1.3
Total	1936	100

resections were undertaken among these patients (Table 2). A significantly higher proportion (27%) of patients with femoral hernias were operated as emergency cases as compared to all other hernia patients ( $\chi^2 = 54.8, f = 1, P < 0.001$ ). Four patients with femoral hernias underwent bowel resection.

### *Treatment and postoperative mortality*

The surgical methods used are listed in Table 3. Significant variations in choice of operation appeared among the hospitals. The most frequent operation was the Bassini repair or a variant thereof. However, in four hospitals the Shouldice technique was performed predominantly. During 1992, 88 patients underwent laparoscopic operations and 72 of those were done during the latter half of the year. Table 4 gives the frequency of suture materials used in the 1936 repairs. Spinal or epidural anaesthesia was used for the majority of operations (Table 5). Thirty-three procedures were performed under local anaesthesia, 21 in one hospital. Four patients died postoperatively (Table 6). As evident, the median age of these patients was 84 years. Three of them were operated as emergency cases and two patients presented with femoral hernias.

**Table 5.** Anaesthesia

Type of anaesthesia	No. of procedures
Spinal, epidural	1462
General	493
Local	33
Total	1936

*Waiting list*

A new bill was passed in Sweden on 1 January 1992 stating that a patient who has been on the waiting list for hernia surgery for three months or more must be offered treatment at another hospital. Therefore, it was considered of interest to analyse separately time on waiting list for patients with a decision to operate before and after this date. As shown in Table 7, 63% of electively treated patients had to wait three months or longer to have their operation done before 1 January 1992, whereas the corresponding figure for patients seen after this date was 13%.

*Day surgery and hospital stay*

Of all 1936 operations 588 or 30% were performed as day surgery. There was a great variation in day surgery rate between the eight hospitals, range 0–59%, and the interhospital difference was highly significant ( $\chi^2 = 266$ ,  $f = 7$ ,  $P < 0.001$ ). The inverse relation between mean hospital stay and day surgery rate at the eight hospitals is illustrated in Figure 1.

**Discussion**

The present registration was initiated in order to study management of groin hernia of adults in a defined and fairly large population, thereby stimulating discussion on outcome and cost-effectiveness in hernia surgery. The mean incidence of hernia surgery in our population was high, 254 per 100 000 inhabitants per year with a considerable interhospital variation. Ambitions to reduce or abolish waiting lists might have caused some artefacts as the operation rate was 20% higher in the first compared to the latter half of the year. Our operation rate is of the same size of order as observed in the USA, Australia and Norway where access to elective surgery is good<sup>9</sup>. In the UK, however, regional age- and sex-standardized rates for primary inguinal hernia repair vary from 115–170 per 100 000 inhabitants per year (including hernia surgery below the age of 15 years which accounts for 15% of all inguinal hernia repairs, but excluding hernia surgery in the private sector)<sup>10</sup>.

The distribution among different types of hernias with a 30% fraction of direct hernias observed in the present survey is in accordance with previous reports<sup>11,12</sup> as is the preponderance of females and the high percentage of acute operations among femoral hernia patients<sup>1,13</sup>.

Reoperations for groin hernias invariably indicate surgical failures of the past. Hence, reoperation rate might

indirectly and with some delay reflect the standard of hernia surgery within the population studied. It should be differentiated from recurrence rate which refers to a cohort of patients reinvestigated at a given time after operation requiring knowledge of the method of control, the completeness of follow-up, and of the definition of recurrence used in order to make comparisons with other series meaningful<sup>7</sup>. However, unless drastic changes in surgery have been undertaken recently a correlation between reoperation rate and recurrence rate is to be expected. The mean reoperation rate observed in the present survey, 17%, is a matter for great concern. For comparison it might be noted that the average reoperation rate in England falls slightly below 10%<sup>10</sup>.

Long-term outcome following hernia surgery depends on several factors, surgical experience and training of junior staff members, choice of technique and suture material. In our eight hospitals, the Shouldice technique was used in 25% of all operations. According to a recent report a similar fraction (26%) of consultant surgeons in the UK practised this technique<sup>14</sup> which, in contrast to other hernia repair methods in experienced hands, has produced long-term recurrence rates of around 1%<sup>2-4</sup>. However, a learning curve is to be expected by surgeons adopting the Shouldice technique<sup>15</sup>. It should also be pointed out that the original description of the Bassini technique encompassed a complete division of the transversalis fascia as well as a reconstruction of the floor of the inguinal canal<sup>16</sup> which is often omitted in modern Bassini modifications. Another observation of interest in our study was the obvious increase in laparoscopic hernia surgery. The cost-effectiveness and outcome of this operation remains to be evaluated. The healing phase of fascia and aponeurose is known to last for some three months. The use of non-absorbable sutures as advocated in the Shouldice technique is therefore logical. In the present survey polyglycolic and polyglactin 910 sutures with a variable retention of tensile strength (50% may be lost in 15 days *in vivo*)<sup>17</sup> were used in 26% of operations.

A mean day surgery rate of 30% was observed in this study with an interhospital range from 0–59%. Although local factors beyond the scope of this survey might contribute to the size of this variation, it nevertheless suggests that routine management of our hernia patients needs re-evaluation. In a controlled study of day-case herniorrhaphies no surgical adverse effects were observed when day cases were compared with inpatients<sup>18</sup>. One Canadian study demonstrated that day surgery was an appropriate form of care for hernia patients<sup>19</sup> and the same conclusion was reached for elective day-case herniorrhaphy by the Commission on the Provision of Surgical Services of the Royal College of Surgeons of England in 1985<sup>20</sup>.

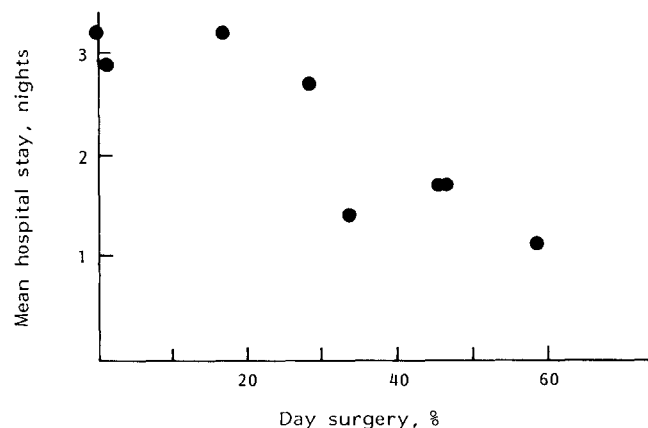
Thus, the present study has indicated topics worthy of further consideration – a high reoperation rate, great variations in application of surgical methods with a still low but increasing use of laparoscopic surgery, and great differences in day surgery rate. The protocol used has been suitable for collection of data concerning manage-

**Table 6.** Details of four patients who died postoperatively

Age	Sex	Indication to operate	Hernia type	Bowel resection
72	Male	Acute	Femoral	No
83	Male	Elective	Combined	No
85	Female	Acute	Femoral	Yes
91	Male	Acute	Direct	No

**Table 7.** Waiting list

Time on waiting list (days)	Before 1 January 1992		After 1 January 1992	
	n	%	n	%
0-89	161	37	1273	87
≥ 90	269	63	186	13
Total	430	100	1459	100



**Figure 1.** Day surgery vs. hospital stay – eight hospitals.

ment of groin hernias and has allowed interhospital comparisons which may be powerful incentives for improvements. The register may be used as a basis for audit of outcome and it may allow comparisons over time.

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