10 Groin Hernia

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1 Summary

Statement of the problem

Groin hernia are very common and surgical treatment is recommended for the majority of patients. Groin hernia repair is the commonest general surgical procedure in the UK. Despite the gradual move to day-case procedures, waiting times for surgery have increased.

Sub-categories

Groin hernia are types of abdominal hernia. There are three types of groin hernia, classified according to the anatomical defect: direct and indirect inguinal hernia and femoral hernia. Femoral hernia are more likely to strangulate than are inguinal hernia, and indirect inguinal hernia are more likely to strangulate than are direct. It is usually possible to distinguish clinically between inguinal and femoral hernia, but distinguishing between indirect and direct inguinal hernia is less reliable.

Prevalence and incidence

Groin hernia are more common in men than in women, and become increasingly common with advancing age. Up to one in four men will develop a groin hernia at some stage.

Services available

There are three treatment options: make a surgical repair, supply a truss or 'do nothing'. Surgery is recommended for all groin hernia in children and for femoral hernia in adults. Surgery is also the appropriate choice for most adults with indirect hernia, to relieve symptoms and to reduce the risk of serious complications. 'Do nothing' may be the best option in elderly males with a symptom-free direct hernia.

In NHS hospitals in England in 1995–96, there were 87 700 inguinal hernia repairs and 5150 femoral repairs.

There has been a steady rise in the number of inguinal hernia repairs performed since the late 1980s, with a fall in the numbers of procedures classified as an emergency. Waiting times have increased (median wait 85 days) and there is a wide variation between health authorities. In 1995–96, just under one-third of such repairs were performed as day cases.

The number of femoral hernia repairs has remained steady, with a slight fall in the numbers classified as an emergency. The percentage of repairs performed as an emergency remains high at 43.7%. Waiting times have also increased (median wait 47 days) and the percentage of procedures performed as day cases is low at 11.9%.

Effectiveness of services and their costs

There are no studies examining the outcomes of conservative treatment, although a randomised trial is being conducted in the USA and results will be available in 2–3 years' time. There is no evidence to support the use of trusses for definitive treatment, but they may alleviate symptoms while a patient awaits an operation.

In the main, studies of effectiveness examine the effect of different surgical techniques for inguinal hernia repair. There are no rigorous trials examining techniques of femoral hernia repair. Other issues that may alter the effectiveness of a procedure include the skill or experience of the surgeon, advice given about mobilisation, the type of anaesthetic used and the volume of hernia that a unit treats.

Randomised controlled trials (RCTs) have mostly examined different surgical techniques. The current debate is between open-mesh repairs and extra-peritoneal laparoscopic mesh repairs. Laparoscopic surgery offers benefits in terms of earlier recovery but requires an experienced surgeon to avoid complications and recurrence. The technique incurs more costs for the health service than do open methods, and the procedure takes longer. Laparoscopic repair also requires a general anaesthetic, and so is more difficult to undertake as a day case than as an open-mesh repair.

There is no evidence that the type of admission (day-case or inpatient) or the type of anaesthetic affects the outcome.

The recurrence rate may be estimated from the percentage of repairs performed for recurrent hernia. For NHS hospitals in England in 1995–96 this was 7.2%. The true recurrence rate will be much higher, as many patients do not present for further surgery. Large specialist centres quote recurrence rates of approximately 1%. The low rates seen may be due partly to short periods of follow-up and differences in case-mix, but the skill of experienced hernia surgeons is also likely to be a factor.

The estimated total annual NHS cost for the treatment of hernia for a Primary Care Group (PCG) of 100 000 patients is £160 000.

Quantified models of care and recommendations

The service may be made more cost-effective by increasing day-case surgery and reducing complications and recurrences. The latter requires that surgery is undertaken by experienced surgeons, or at least supervised by them. In part, day-case surgery is limited by the availability of adequate social care for elderly patients.

Societal costs of hernia repair would be reduced by shorter waiting times for surgery and a reduced need for recuperation after it. With modern tension-free repair methods, there is no need to limit activity following surgery.

Femoral trusses should no longer be used, as surgery is the treatment of choice for femoral hernia.

Service providers should publish recurrence rates and complication rates following groin hernia surgery.

Extending the use of laparoscopic surgery may increase waiting times for surgery, increase expenditure and result in more complications in the short term (while surgeons are on the learning curve).

2 Introduction and statement of the problem

A hernia (or rupture) is the protrusion of an organ through the part of the body that usually contains it. In the case of groin hernia, this is the protrusion of a part of the intestine through the abdominal wall into the groin.

The majority of patients with a groin hernia will present with a swelling in the groin, with or without discomfort, often described as a 'dragging' sensation. Where the anatomical defect is large, considerable portions of bowel may protrude from the abdominal cavity, causing an unsightly swelling and discomfort. Hernia may sometimes be confused with other causes of groin swellings, but the main problem in diagnosis is differentiating between different types of hernia or being unable to demonstrate a swelling described by a patient. Such a patient will usually present to the General Practitioner. In a smaller number of cases, a patient will present as an emergency with an incarceration and/or bowel obstruction. Prompt diagnosis and surgical admission is important in these patients. Six per cent of inguinal hernia repairs and 45% of femoral hernia repairs are performed as emergencies (*see* Section 4).

Groin hernia are important because they are common and may result in discomfort and disfigurement, often interfering with the ability to work in manual jobs. There is also the risk of strangulation (where the blood supply to a section of protruding bowel becomes cut off) and intestinal obstruction (where the bowel contents are prevented from travelling through a trapped portion of intestine). The latter complications are life-threatening. Adjacent structures, such as the testis, may also be affected when the bowel becomes incarcerated or strangulated.

Groin hernia can occur at any age. They are common in babies and small children, become less common in the teens and twenties and then rise in incidence throughout the middle and later years of life.

Conventional treatments for hernia are various forms of surgery and trusses, both of which have been in use for a considerable length of time. An Egyptian papyrus (Ebers 1550 BC) described the use of bandaging (the ancient equivalent of a truss) and the use of cathartics and hot poultices for strangulation. The first description of surgery was by Celsus in AD 25.[1]

Because of the long-standing tradition of surgical repair for groin hernia, there are no randomised controlled trials comparing surgical treatment with no treatment or indeed with a truss. There is little evidence for the effectiveness of trusses and some authors believe they cause complications, especially with prolonged use.[2,3]

The objectives of hernia management are to relieve symptoms, to avoid deformity and to prevent complications. Successful surgery fulfils all these objectives; provided that complications are minimal, it would appear to be the ideal choice. Traditionally, trusses have been used for patients who are thought to be poor operative risks or where the risk of complications is low. Trusses may control symptoms, but there is little evidence that they can prevent complications. There is some concern that trusses may increase the risk of incarceration or strangulation, especially of the narrow-necked femoral hernia.[2] With improvements in anaesthetic technique and the advent of regional and local anaesthesia, fewer people are unfit for surgery, and so the majority of patients who would benefit from surgery may be offered it.

Hernia do not correct themselves over time and will often deteriorate, with enlargement of the hernia and increasing discomfort. Successful treatment will prevent such complications, and improvements in quality of life have been demonstrated following hernia repair.[4] It is therefore reasonable to conclude that hernia should be treated; the issue then becomes one of access to effective treatment. Inguinal hernia repair rates in England are lower than in the USA, Australia and Norway, so there is some evidence of reduced access to surgery.[2] Much of the mortality from hernia is potentially preventable, because an adequate repair prevents the complications of strangulation or obstruction. There were 311 deaths in England and Wales in 1995 attributed to inguinal or femoral hernia.[5] There is also considerable variation in mortality

between countries, with England and Wales having the third highest age-standardised mortality in Europe for abdominal hernia in people aged 5–64 years.[6]

Appendix I lists the diagnostic and procedure codes.

3 Sub-categories

A groin hernia is just one cause of groin swelling, but it should be possible to identify a hernia on clinical examination. Groin hernia are the commonest type of abdominal hernia. There are three distinct types of groin hernia:

- **Direct inguinal hernia**
- **Indirect inguinal hernia**
- **Femoral hernia**

Where an indirect hernia extends into the scrotum, it may be referred to as an **inguino-scrotal** hernia.

The anatomical deficit is different for each type.[7–10] It is important to distinguish between types because the clinical course and recommended treatment will depend on the category of groin hernia. Complications are far more frequent in femoral hernia than in either type of inguinal hernia. The distinction between direct and indirect may be made reliably only at operation. A study comparing pre-operative diagnosis of inguinal hernia with peri-operative diagnosis found that surgeons correctly diagnosed 76.9% of indirect hernia and 58.9% of direct hernia.[11]

Groin hernia may also be classified as reducible or irreducible depending on whether the abdominal contents may be returned to the abdomen manually. Irreducible hernia (where the contents may not be easily returned to the abdomen) are more likely to result in complications of strangulation and obstruction. When the hernia is small, it may often go undetected.

Data on incidence, prevalence and procedures are all presented using the anatomical categories, as this is the way in which data have been recorded. Patients may also be categorised in terms of the way they present.

- **Patients who do not present for medical care:** This group may or may not have symptoms, and have varying risks of incarceration or strangulation. Many will eventually migrate to one of the other two categories – i.e. they will present acutely or non-acutely with symptoms of their hernia. This category includes patients in whom a hernia is a chance finding when examined for other medical purposes. They may or may not have symptoms attributable to the hernia. Approximately half of patients with hernia may be unaware of the problem.[12]
- **Non-acute presentation:** Patients have symptoms, usually of pain in the groin and/or groin swelling. Most present in general practice, where a GP or practice nurse will assess them. Some patients may choose to have an operation to relieve them of their symptoms. Others who are felt to be at high risk of strangulation (particularly those with a femoral hernia) may be advised to have an operation. Some patients with inguinal hernia, especially the elderly, may prefer not have an operation.
- **Acute presentation:** Patients present acutely with symptoms of complications, usually abdominal pain and/or bowel obstruction. Emergency admission and surgery are required. The cause of the symptoms – the hernia itself – may be missed, especially in a patient who has not had a hernia previously diagnosed. Based on the 1995–96 Health Episode Statistic (HES) data, approximately 8% of all hernia operations are performed as emergencies.

4 Incidence and prevalence

Incidence

There are no population-based studies that measure the incidence of groin hernia. Incidence may be measured only in terms of health care contacts, because many patients may be unaware of their hernia or do not seek medical attention.

Primary care consultations

Demand-incidence data for inguinal hernia have been derived from the fourth national GP morbidity survey,[13] which took place during financial year 1991/92. Sixty practices volunteered, with a total of 502 493 patients resulting in 468 042 person-years of observation. The data in Table 1 show the numbers of new and first-ever appointments in general practice for inguinal hernia. This incidence rate will underestimate the true incidence, because many people do not seek advice for their hernia and the data set may be incomplete. (Under-reporting by GPs was estimated to be about 5% for consultations but much higher for referrals to secondary care.)

Table 1: Incidence rates (95% CIs) of inguinal hernia per 10,000 person-years at risk.

Age band in years	Incidence rate in males	Incidence rate in females
0–4	46 (36.5–58.1)	8 (4.3–13.7)
5–15	9 (6.2–13.2)	2 (0.9–4.5)
16–24	11 (7.5–15.4)	1 (0.3–3.1)
25–44	21 (17.8–24.7)	2 (1.2–3.4)
45–64	62 (55.2–69.4)	5 (3.3–7.5)
65–74	118 (103–135)	9 (5.4–14.6)
75–84	182 (159–209)	14 (8.6–23.3)
85 and over	190 (141–259)	37 (18.4–74.2)
All ages	43 (40.4–45.8)	5 (4.2–6.0)

Source: MSGP4, 1991/92. First-ever or new consultations per 10,000 patients at risk.

Volunteer practices tended to be larger than average, with younger practice principals. There were also some socio-economic differences between the population studied and the overall population of England and Wales. For instance, ethnic minorities were under-represented in the practice populations.

Data on femoral hernia are not available from MSGP4, because data were analysed at a higher level of diagnostic code. Data have therefore been derived from the third national GP morbidity survey,[14] which took place in financial year 1981/82. Data were obtained from 48 volunteer practices, caring for 332 270 patients and contributing 307 803 person-years to the study. These incidence data are shown in Table 2 (*see* overleaf).

These estimates show femoral hernia incidence in women to be lower than in men. Femoral hernia repairs are more commonly performed in women (*see* Section 4). Women are also more likely to require

Table 2: Incidence rates (95% CIs) for femoral hernia per 10,000 person-years at risk.

Age band in years	Incidence rate in males	Incidence rate in females
0–4	2 (0.3–7.9)	0 (0.0–5.0)
5–14	0 (0.0–2.0)	0 (0.0–2.2)
15–24	2 (0.8–5.4)	0 (0.0–2.0)
25–44	1 (0.3–2.7)	2 (1.0–3.9)
45–64	1 (0.3–3.1)	2 (0.8–4.3)
65–74	1 (0.0–5.4)	2 (0.5–6.3)
75 and over	9 (3.8–21.2)	7 (3.5–14.1)
All ages	2 (0.5–6.5)	2 (0.5–5.9)

Source: MSGP3 1981/82. First-ever and new consultations for femoral hernia.

emergency repair for their femoral hernia than are men. It appears that women are less likely to present to their GPs with groin swelling and consequently are at greater risk of strangulation and emergency presentation. Alternatively, GPs may be less likely to diagnose groin hernia in women.

Using the demand–incidence rates from general practice, and the population structure of England (mid-1995 population estimates), the expected numbers of groin hernia patients in an average PCG of 100 000 have been calculated. These are summarised in Table 3.

Table 3: Expected numbers of groin hernia patients in a population of 100,000.

Type of hernia	Inguinal	Femoral
Male	220	7
Female	27	9
Total	247	16

The numbers of surgical procedures performed also form an estimate of incidence, although not all patients are referred for surgical opinion and not all those assessed by a surgeon will be offered surgery. Health service activity data are summarised in Section 4.

Prevalence

Data on prevalence rates come from the GP morbidity survey (MSGP4)[13] and from community studies.

Primary care consultations

Prevalence estimates have been derived from the morbidity survey data (*see* Table 4). These are available only for inguinal hernia.

Table 4: Estimated inguinal hernia prevalence from GP morbidity studies, rates per 10,000 person-years at risk (95% CIs).

Age band	Prevalence rate in males	Prevalence rate in females
0–4	52 (41.5–64.4)	7 (3.9–12.9)
5–15	10 (6.9–14.3)	2 (0.92–4.5)
16–24	14 (10.3–19.2)	2 (0.8–4.4)
25–44	25 (21.6–29.1)	3 (1.9–4.6)
45–64	83 (74.8–91.2)	7 (4.9–9.8)
65–74	156 (139–175)	10 (6.2–15.9)
75–84	262 (234–293)	18 (11.8–28.4)
85 and over	267 (206–343)	35 (15.6–63.5)

Source: MSGP4.[13]

Community surveys

There have been no comprehensive prevalence studies of groin hernia in the wider community. The most comprehensive reference is a paper by Abramson *et al.*[12] They undertook a community survey of men in western Jerusalem using a combination of interview and clinical examination. The prevalence of unrepaired inguinal hernia was recorded, as well as any history of hernia repair. The results of their survey are summarised in Table 5.

Table 5: Prevalence of inguinal hernia by age group.

Age group examined (years)	25–34	35–44	45–54	55–64	65–74	75 plus	Total
No. of men examined	620	438	300	322	156	47	1,883
Current prevalence (excluding successful repairs)	11.9%	15.1%	19.7%	26.1%	29.5%	34.1%	18.3%
Lifetime prevalence (including successful repairs)	15.2%	19.4%	28.0%	34.5%	39.7%	46.8%	24.3%

Source: Abramson *et al.*[12]

To ensure consistency of diagnosis, all the examining doctors were trained in the examination and clinical diagnosis of inguinal hernia using the method described by Bailey.[15] While consistency is assured, however, the data will not be entirely accurate, as clinical diagnosis is not always confirmed at surgery.[11] A cough impulse at a scar site was taken as a recurrence. Response rates from those aged under 25 years were low and so the analysis was confined to men aged over 24 years. The poor response rate in the younger group was thought to be a result of service in the armed forces. The response rate for interviews in the 25-plus group was 86%, 91% of whom participated in the follow-up examination.

This study shows an increasing prevalence of inguinal hernia with increasing age in adult males. Hernia were more common on the right in a ratio of 1.3 to 1. One in every five of all hernia showed evidence of recurrence. Only 54% of men with an unoperated swelling reported having a hernia. It is not known how well these results translate to the UK population.

Abramson *et al.* also summarised comparative studies on hernia prevalence from other countries. The results of their study were comparable with those from the other studies and so are likely to be a reasonable estimate. They show that the prevalence estimates from the GP morbidity survey[13] are gross underestimates, even assuming that only half of those with a hernia are aware of it.

Prevalence estimates from other studies are summarised in Table 6, adapted from Abramson *et al.*

Table 6: Prevalence estimates of types of abdominal hernia.

Study	Population	Prevalence rate of hernia
Cohen J and Efran Male, 1964	Israel. Males aged 17–18 in the cohort born in 1940. Inguinal hernia.	0.8%
Zimmerman LM, Anson BJ, 1967[16]	USA. First million drafted in World War I. All hernia.	2.0%
Zimmerman LM, Anson BJ, 1967[16]	USA. Selective service registrants. 3 million from World War II. All hernia.	8.0%
Nilsson JR, 1937[17]	USA. Routine examination of 7,967 railroad workers. All hernia, including operated.	9.5%
Trussell RE, Elinson J, 1959[18]	USA, New Jersey. All abdominal hernia; probability sample of 277 men aged 25 and over.	5.3% (25–44 years) 6.0% (45–64 years) 22.9% (65 plus)
Zimmerman LM, Anson BJ, 1967[16]	UK. Recruits in World War I.	0.6%–12.5%, depending on age
Edwards H, 1943[19]	UK. Recruits in World War II. Abdominal hernia; 1,300 men aged 35–36 years.	11.0%
Yordanov YS, Stoyanov SK, 1969[20]	Pemba (an island close to Zanzibar). Hospital patients or relatives of patients not attending with hernia. Inguinal hernia in 528 men aged over 21 years.	25.2%

Several African studies have demonstrated a prevalence in adult males of between 7.7% and 25.2%.[21] It is not possible to comment on possible ethnic differences in hernia prevalence, because studies have used non-comparable samples.

Akin *et al.* studied a series of 27 400 army recruits aged between 20 and 22 years in Turkey in 1995.[22] An inguinal hernia was found in 3.2% of men, with 54.1% being right-sided, 39.7% left-sided and 6.2% bilateral.

Surgery for groin hernia

Using the hospital-episode data for England for financial year 1995/96, the ratio of primary inguinal hernia repairs to primary femoral repairs was 16.4:1. Although hernia repairs were much more common in men

than in women (ratio 7.6:1), femoral hernia repairs were more common in women than in men. The ratio of primary inguinal hernia repair to primary femoral hernia repair is 50:1 in men and 1.9:1 in women. These figures do not reflect the total incidence of groin hernia, as there will be patients who do not present, patients who are not referred from general practice and patients who are not offered or who refuse surgery.

Barwell described a series of over 4000 groin hernia repairs.[21] In these, the ratio of indirect to direct inguinal repairs was 8.3:1 in women and 2.4:1 in men.

Complications of groin hernia

Strangulation and incarceration

Estimates of the risks of strangulation vary enormously, but many of them seem to be based on hearsay rather than on fact. Gallegos[23] studied 476 hernia repairs in a UK hospital population and used Kaplan–Meier survival analysis to estimate the cumulative probability of strangulation over the length of the clinical history. For inguinal hernia, the cumulative probability of strangulation was 2.8% at 3 months, 4.5% after 2 years and 8.6% after 5 years (i.e. an estimated annual strangulation risk of 1.7%). For femoral hernia, the cumulative probability of strangulation was 22% at 3 months and 45% at 21 months. They demonstrated that the cumulative risk of strangulation increased at the greatest rate in the first three months of the history. They also found that patients who were admitted with a strangulated hernia had much shorter clinical histories than those on the waiting list. This suggests that hernia at risk of strangulation may strangulate before patients are referred to hospital.

McEntee *et al.*[24] undertook a retrospective study of 79 patients who presented with clinical evidence of strangulation between 1979 and 1987. Forty-six (58%) had noticed a hernia for at least one month prior to strangulation. Of these, 39% had not reported the hernia to their GP, 41% had reported the hernia to a doctor but had not been referred for surgical opinion and 20% had been assessed surgically with a view to elective repair. Forty per cent of patients had presented within days of developing a hernia. In a smaller study by Allen *et al.*, 18 of 25 patients with strangulated hernia had known of their hernia for over a year before the emergency admission.[25]

Neuhauser made two estimates of the annual risk of strangulation.[26] The first was based on a series of 8633 patients with inguinal hernia described by Berger[27] in 1895 and gave a probability of strangulation or obstruction of 0.4% per annum. Berger questioned patients who came to see him for the fitting of a truss, asking them the length of history and whether they had had any episodes of obstruction or incarceration. Neuhauser states that Berger's data showed a mortality from incarceration of 8.5%, and therefore increased the rate of strangulation or incarceration by 10% to account for this. It is not at all clear how Berger could have demonstrated a mortality rate from strangulation when he studied live patients.

The second source of data used was an unpublished study in Columbia where almost no routine hernia operations were performed. The numbers of operations on strangulations or incarceration were related to the population at risk. The yearly probability of strangulation was 0.3%. There are several problems with this estimate. It assumes that anyone in the designated population with incarceration or strangulation would have been admitted to hospital and operated on. The data also assume that it was possible to identify accurately a population at risk. The epidemiology of groin hernia appears to vary in different ethnic populations, so the results of studies in Columbia may not be applicable to a European population.[28,29]

Mortality

Mortality from groin hernia may occur from the complications of groin hernia (usually strangulation or incarceration) or from the complications of surgery. The mortality rate is much higher following

emergency surgery than after elective surgery. Mortality following either emergency or elective surgery has fallen over the years.

Charlton *et al.*[30] demonstrated huge differences in mortality from abdominal hernia between health authorities for the years 1974–78. These differences were still present even when accounting for differences in population structure and differing levels of deprivation. It seems likely that such inequalities still exist today. These differences may reflect the quality and accessibility of services provided. However, the data refer to all types of abdominal hernia, and it is difficult to be sure that these inequalities would still be present if groin hernia were looked at in isolation.

The largest series of strangulated hernia was described by Frankau in 1931.[31] He studied 1487 strangulated abdominal hernia from a number of hospitals in Britain and Ireland. Mortality rates from strangulation were 12.6% for inguinal hernia and 12.9% for femoral.

Reaveley *et al.*[6] studied deaths from abdominal hernia in Nottingham over a six-year period. The majority had presented with symptoms of incarceration or strangulation. Of the 20 deaths from inguinal hernia, only half had had a history of the hernia documented in GP records.

Based on 1995/96 HES data, approximately 8% of operations are performed as emergencies. The indication for emergency surgery would be complications, so this figure of 8% gives an estimate of the lifetime risk of strangulation or incarceration. This risk estimate applies to current surgical practice, so complication rates would be much higher if no repairs were done as routine.

Mortality data from death certificates

For calendar year 1995 in England and Wales, there were 721 deaths where abdominal hernia was given as the underlying cause. Inguinal hernia caused 183 deaths and femoral hernia 128. 75.4% of the inguinal hernia deaths and 85.2% of the femoral hernia deaths were in people aged 75 years and over.

Deaths following hernia surgery

In 1995/96, there were 256 deaths in hospital following groin hernia surgery. The numbers of deaths by operation type and admission method are summarised in Table 7. Deaths are more common following emergency surgery than following elective surgery. Death is more common following femoral hernia surgery than following inguinal surgery.

Table 7: Mortality rate from groin hernia repair, using admissions where the discharge method was death.

Mortality rate (number of deaths)	Excision of inguinal sac	Primary inguinal	Recurrent inguinal	Primary femoral	Recurrent femoral
From elective surgery	0% (0)	0.05% (31)	0.09% (5)	0.19% (5)	0% (0)
From emergency surgery	0.29% (3)	2.66% (99)	3.19% (15)	4.33% (96)	4.35% (2)

Source: HES data 1995/96.

Overall mortality rates following groin hernia repairs are in Table 8.

Table 8: Mortality rates from groin hernia surgery.

	Mortality rate, emergency admissions (95% CIs)	Mortality rate, elective admissions (95% CIs)
Inguinal repairs	2.24% (1.9–2.3)	0.04% (0.03–0.06)
Femoral repairs	4.33% (3.5–5.3)	0.18% (0.07–0.47)

Source: HES data 1995/96.

Trends in groin hernia deaths following surgery are demonstrated in Figure 1. These are the numbers of admissions for groin hernia repair where the discharge method was death – i.e. they do not include any deaths that occurred following discharge from hospital.

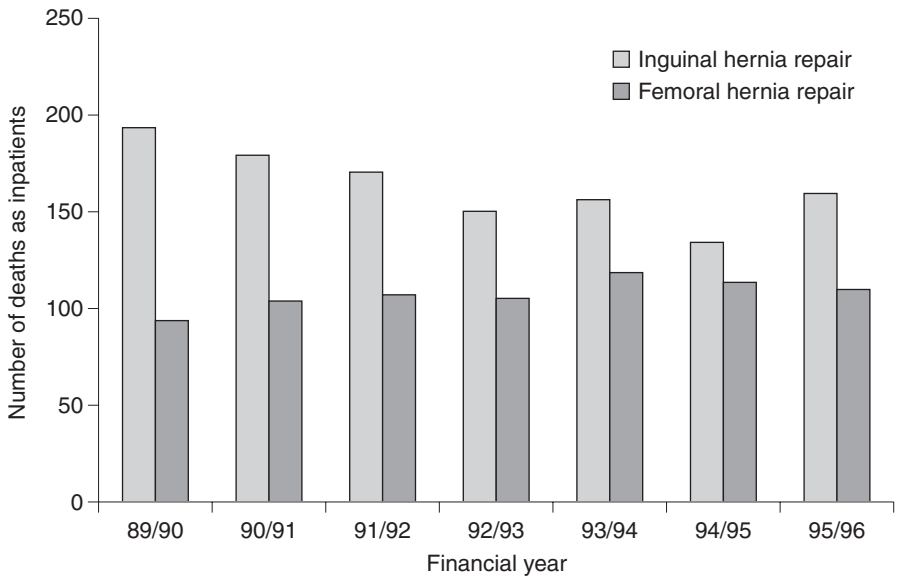

Figure 1: Trends in deaths following groin hernia surgery between 1989/90 and 1995/96.
Source: HES data, 1989/90–1995/96.

5 Services available and their costs

Treatment options

The investigation and management of groin hernia is usually straightforward. Patients are not routinely screened for hernia, although one may be detected as part of a physical examination. Small hernia may go unnoticed even by the patient, and patients with symptoms or signs do not all present to the GP.

A patient with groin hernia has three choices: no treatment, a truss or surgical repair. PCGs need to develop clear guidelines for referral and management in partnership with surgical colleagues.

No treatment

This has been advocated for small, direct hernia in the elderly and for people regarded as too infirm to withstand surgery. Patient selection on clinical criteria is likely to fail, because the differentiation between direct and indirect inguinal hernia can be made with certainty only at operation.[11] A policy that legitimises patient selection may explain the large numbers of patients whose family doctors do not refer for surgical opinion.

Truss

Although there remains a perception amongst patients and some doctors that a truss can be used to manage an inguinal hernia, there is no evidence base to support the truss as a definitive treatment.[2] However, a truss may be used to alleviate symptoms in a patient awaiting surgery. In 1991, an estimated 40 000 trusses were provided annually in the UK.[32] For the 12-month period December 1998 to November 1999, 16 000 trusses were prescribed in England, 32 of them for femoral hernia.*

Surgery

Surgery is of two types: **traditional open surgery** or **laparoscopic repair**. A laparoscopic repair is either **totally extra-peritoneal (TEP)** or **transabdominal preperitoneal (TAPP)**. The latter repair involves entering the peritoneal cavity, and is being superseded by the TEP approach. The commonest repair uses a mesh prosthesis stapled over the hernial orifice and then covered by peritoneum to prevent local adherence to the bowel.

Inguinal hernia repair

In open surgery an incision is made in the inguinal region, with exposure of the hernia. The sac is excised or reduced. In all but infant hernia procedures, the posterior wall of the inguinal canal is repaired or reinforced, with support and narrowing of the internal inguinal ring. These features are common to all open repairs. The procedure can be carried out under general or local anaesthesia if the hernia is reducible and the patient is not obese.

The precise nature of the surgical repair depends on the operator's preference. Essentially there are two choices:

- the **Shouldice repair**[33] involves overlapping reinforcement of the transversalis fascia
- the **Lichtenstein technique**[34] involves the insertion of a prosthetic mesh.

It is important to note that most surgeons use a modification of an originally described method, which may have evolved considerably by passage through the hands of several surgeons.

* *Source*: Prescription Pricing Authority.

Femoral hernia repair

There are three main methods of femoral hernia repair:

- the **high** approach
- the **transinguinal** approach
- the **low** approach.

Laparoscopic methods and mesh may also be used.

Current service provision

Data on service provision in this report are based on hospital-episode data from NHS hospitals in England (HES data). The data have been analysed on the basis of admissions rather than finished consultant episodes (FCEs). Data have been extracted on the basis of procedure codes (OPCS4 – *see* Appendix I). The procedure rates and any trends in service provision in the NHS need to be considered in the light of private health care provision over the same time period.

Volume of surgery

Inguinal hernia repair

In the financial year 1995/96, there were 87 651 inguinal hernia repairs in NHS hospitals in England. Of these, 81 323 (92.8%) were primary repairs and 6328 (7.2%) recurrent repairs. These represent a crude repair rate (per 100 000) of 180, a crude primary repair rate of 167 and a crude recurrent repair rate of 13.0. 91% of operations were recorded as on men and 7.6% on women, while in 1.6% of admissions the gender was unclassified. There has been a steady increase in the numbers of operations performed annually since the late 1980s. This contrasts with the previous 15 years, when numbers had on average remained static.[21] Between 1989/90 and 1995/96, inguinal hernia repairs rose by 27% in men and 5% in women. It is not clear why there is this gender disparity.

In 1995/96, 89.5% of inguinal hernia repairs were performed as a single procedure (i.e. no additional procedures were performed at the same time). This compares with 83% in 1989/90. This change may have arisen as a result of the increase in day-case surgery – combined procedures are not suitable for day-case repair. Alternatively, it could be an artefact of the coding or of the data analysis.

Applying incidence rates in general practice to the population in England, there would be an estimated 120 314 new cases of inguinal hernia per annum in England presenting to general practitioners (107 258 men and 13 056 women). For the year 1995/96, there were only 87 651 hernia repairs, which suggests that only 73% of those presenting to GPs have an operation.

Femoral hernia repair

In the financial year 1995/96, there were 5146 femoral hernia repairs in NHS hospitals in England. Of these, 4951 (96.2%) were primary repairs and 195 (3.8%) recurrent repairs. These represent an overall crude repair rate (per 100 000) of 10.6, a crude primary repair rate of 10.2 and a crude recurrent repair rate of 0.4. The number of femoral hernia repairs performed annually remained steady between 1989/90 and 1995/96, a pattern similar to that seen in the previous 15 years.[21]

Applying incidence rates in general practice to the population in England, there would be an estimated 8012 new cases of femoral hernia per annum in England presenting to general practitioners (3470 men and

4540 women). For the year 1995/96, there were only 5146 hernia repairs, which suggests that only 64% of those presenting to GPs have an operation.

In 1995/96, 83.5% of femoral hernia repairs were performed as a single procedure, compared with 72.5% in 1989/90. Only 31.8% of recurrent femoral repairs were performed as single procedures. The apparent increase in single procedures may have arisen as a result of the increase in day-case surgery – as we remarked earlier, combined procedures are not suitable for day-case repair. Alternatively, it could be an artefact resulting from different methods of analysing the HES data or from the effect of changes in coding practice.

Procedure rates by age and gender

Rates have been calculated using the ONS mid-1995 population estimates for England. Some of the rates are derived from very small actual numbers, so the confidence intervals on these would be wide.

Inguinal hernia repair

The procedure rates for inguinal hernia are summarised in Table 9.

Table 9: Rates of inguinal hernia repair by age and gender.[a]

Age band in years	Primary repairs				Recurrent repairs			
	No. of repairs		Rate per 10,000 population		No. of repairs		Rate per 10,000 population	
	Male	Female	Male	Female	Male	Female	Male	Female
0–4	8,606	856	51.9	5.4	54	5	0.3	0.03
5–14	3,916	732	12.3	2.4	57	5	0.2	0.02
15–24	2,728	155	8.5	0.5	69	5	0.2	0.02
25–44	10,610	854	14.5	1.2	490	27	0.7	0.04
45–64	23,084	1,378	42.5	2.5	2,077	60	3.8	0.11
65–74	14,473	1,041	73.2	4.4	1,866	33	9.4	0.14
75–84	8,608	1,077	93.0	6.9	1,230	37	13.3	0.24
85 plus	1,529	340	70.8	5.2	210	14	9.7	0.22
All ages	73,554	6,433	30.8	2.6	6,053	186	2.5	0.07

[a] These data exclude 5 admissions where the age was not known and 1,420 admissions where the gender was not known.

Age- and sex-specific rates of primary and recurrent hernia repair are shown in Figures 2 and 3.

Inguinal hernia repairs are much more common in men than in women at all ages. The age-specific rates are high in infants and in the elderly. Ninety-one per cent of procedures were recorded as performed on men and 7.6% on women, while in 1.6% of procedures the gender was unclassified.

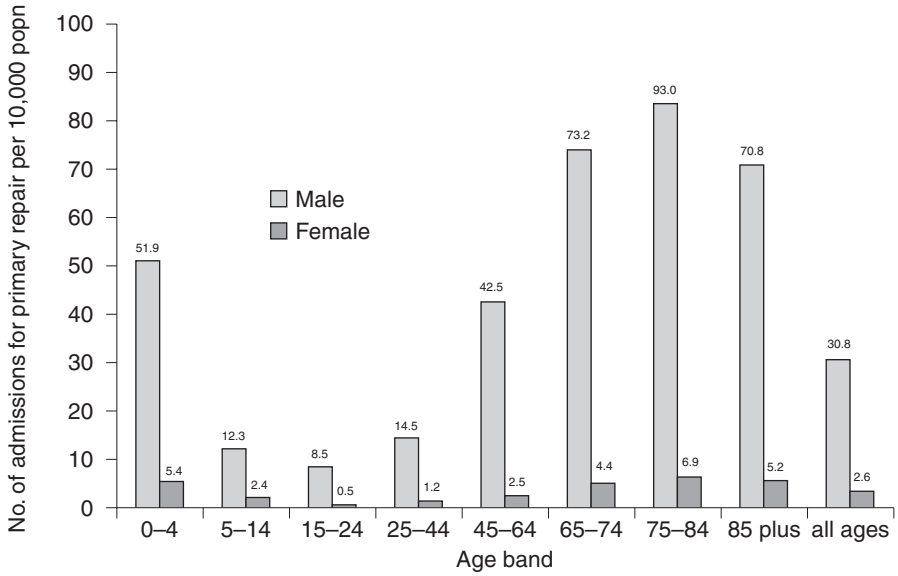

Figure 2: Age- and sex-specific primary inguinal hernia repair rates.
Source: HES data 1995/96.

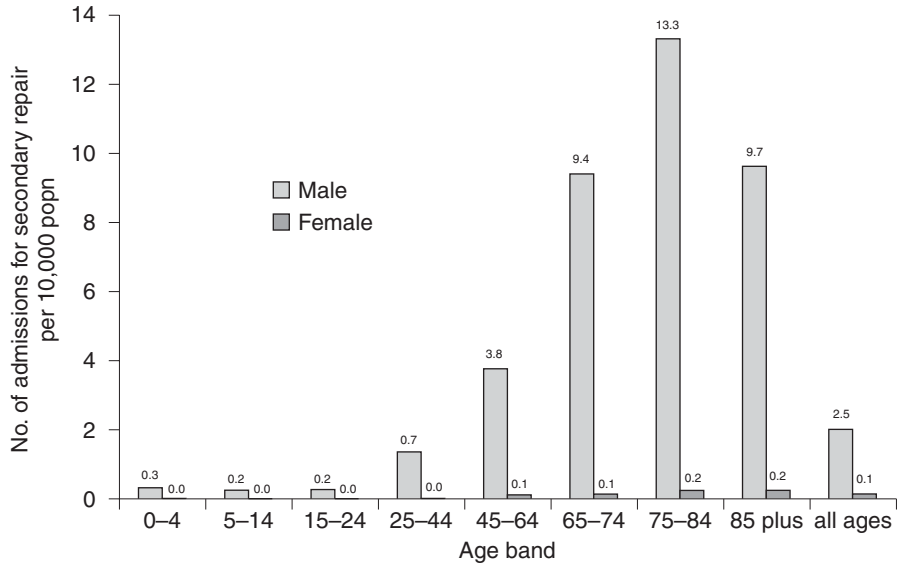

Figure 3: Age- and sex-specific recurrent hernia repair rates.
Source: HES data 1995/96.

Femoral hernia repair

In 1995/96, 68.1% of femoral hernia repairs were recorded as performed on women and 31.0% on men, while in 0.9% of admissions the gender was not classified.

Age- and gender-specific rates of femoral hernia repair are presented in Table 10. Many of the rates are calculated from small actual numbers, so the confidence limits on the rates would be wide. Femoral hernia repairs are more common in women than in men.

Age- and gender-specific primary and recurrent femoral hernia repair rates are demonstrated in Figures 4 and 5.

Table 10: Rates of femoral hernia repair by age and gender, England 1995/96.*

Age band in years	Primary repairs				Recurrent repairs			
	No. of repairs		Rate per 10,000 population		No. of repairs		Rate per 10,000 population	
	Male	Female	Male	Female	Male	Female	Male	Female
0–4	10	8	0.6	0.5	1	1	0.1	0.1
5–14	28	25	0.9	0.8	3	2	0.1	0.1
15–24	20	32	0.6	1.1	0	1	0.0	0.0
25–44	105	434	1.4	6.1	6	13	0.1	0.2
45–64	426	765	7.9	13.9	22	29	0.4	0.5
65–74	395	756	20.0	31.8	25	29	1.3	1.2
75–84	369	887	39.9	57.0	20	23	2.2	1.5
85 plus	118	501	54.6	77.3	2	17	0.9	2.6
All ages	1,471	3,408	6.2	13.7	79	115	0.3	0.5

Source: HES data 1995/96.

* These data exclude 1 admission where the age was not known and 72 admissions where the gender was not known.

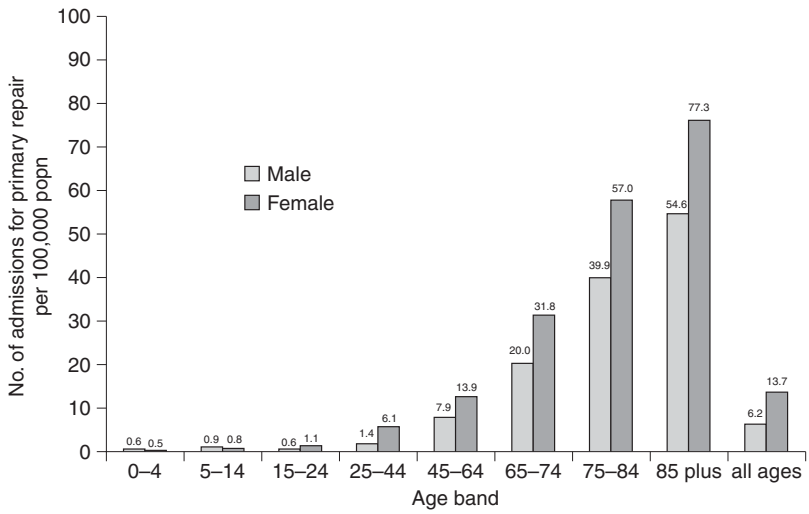

Figure 4: Age- and gender-specific primary femoral hernia repair rates.
Source: HES data 1995/96.

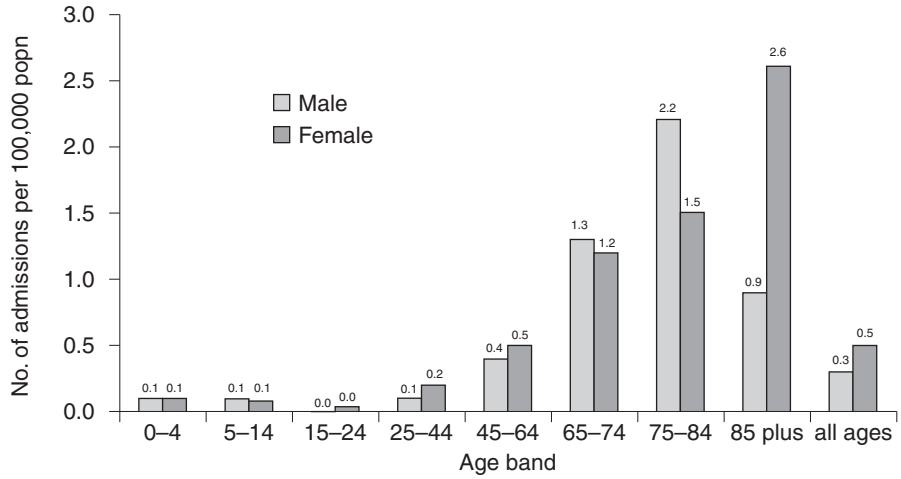

Figure 5: Age- and gender-specific recurrent femoral hernia repair rates.
Source: HES data 1995/96.

Day-case surgery

Inguinal hernia repair

There has been a steady increase in the percentage of operations performed as day cases over the seven-year period examined. This trend is seen in all three types of procedure, but day-case surgery is much more common in primary repair than in recurrent repair. These trends are demonstrated in Figure 6.

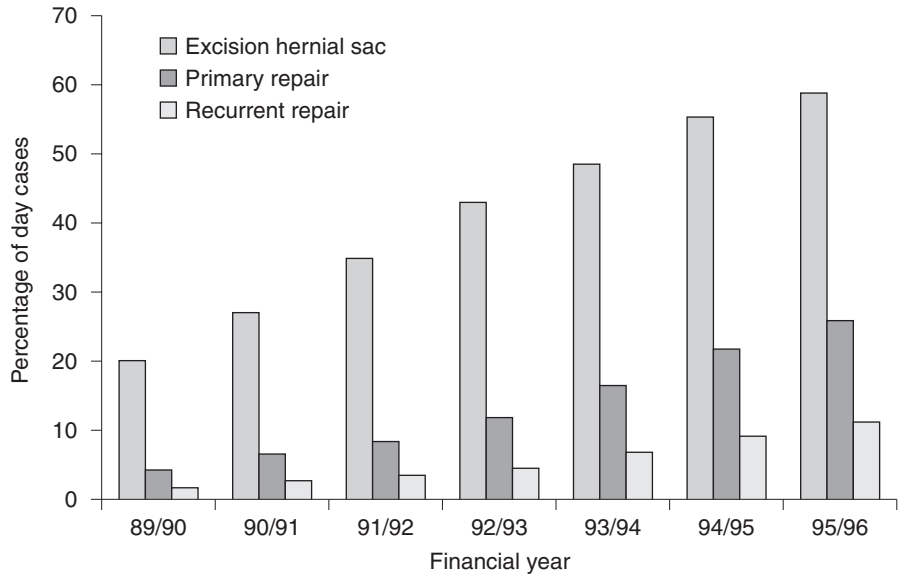

Figure 6: Trends in percentage of inguinal hernia repairs performed as day cases, by procedure type.
Source: HES data 1989/90–1995/96.

For the financial year 1995/96, 29.7% of all inguinal hernia repairs were performed as day cases. Of the 81 126 elective inguinal hernia repairs, 32.1% of were done as day cases. 65.5% of elective repairs were performed in people under 65 years and 86.0% were performed in people under 75 years. If all elective surgery in those under 65 years were done as day cases, there would be a 104% rise in day-case surgery numbers. If all elective surgery in those under 75 years were done as day cases, there would be a 168% rise in day-case surgery numbers.

The percentage of operations performed as day cases falls with increasing age (Figure 7).

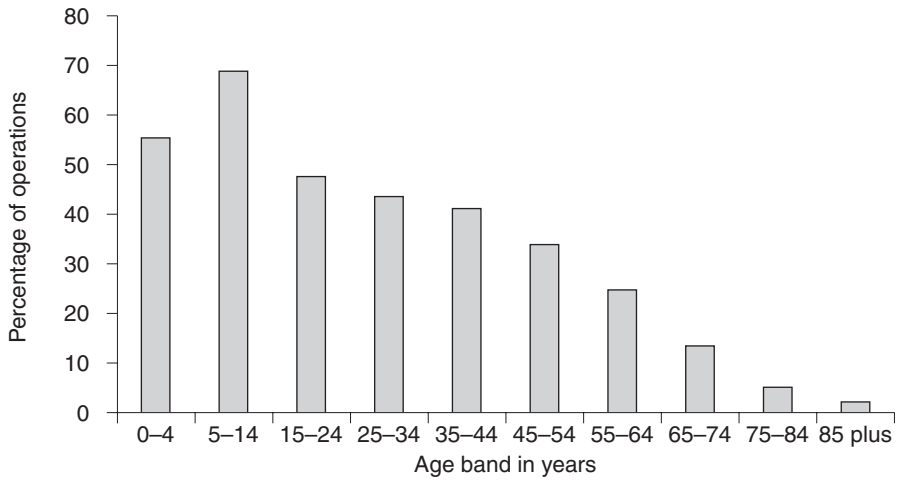

Figure 7: Percentage of inguinal hernia procedures performed as day cases, by age.
Source: HES data 1989/90–1995/96.

While it is understandable that elderly patients are admitted to hospital for their hernia repairs, it seems surprising that less than half of people in their twenties and thirties are operated on as day cases. Some patients may have had associated procedures that necessitated admission and some will have been admitted as emergencies, but these are unlikely to account for more than about 10%.

Despite the growth in day-case surgery, there remains potential for further expansion. Patients who are not felt suitable for day-case hernia repair are usually those who do not have adequate support at home or who are particularly frail. This usually affects the elderly. Some day-case units operate an age-based policy, generally offering day-case surgery to younger patients only. Units in the West Midlands have quoted cut-off ages of 65 to 75 years. Specialist independently-funded hernia centres usually do all of their surgery on a day-care basis,[35,36] but it may be that they do not have any frail, elderly customers without social support. Some of the specialist centres only undertake surgery that uses local anaesthesia.

Tables 11 and 12 show the numbers of admissions by age and gender for day-case surgery and for ordinary admissions.

Table 11: Numbers (%) of day cases for inguinal hernia repair, by age and gender.

Age band in years	Simple excision of hernia sac			Primary inguinal repair			Recurrent inguinal repair			Totals
	Male	Female	Unclassified	Male	Female	Unclassified	Male	Female	Unclassified	
0–4	4,119 (15.8%)	387 (1.5%)	18	733 (2.8%)	119 (0.5%)	0	21 (0.1%)	2	0	5,399 (20.7%)
5–14	2,214 (8.5%)	401 (1.5%)	11	491 (1.9%)	169 (0.6%)	1	37 (0.1%)	3	0	3,327 (12.8%)
15–24	102 (0.4%)	8	0	1,197 (4.6%)	82 (0.3%)	10	22 (0.1%)	2	0	1,423 (5.5%)
25–34	34 (0.1%)	3	0	2,227 (8.6%)	132 (0.5%)	7	57 (0.2%)	3	0	2,463 (9.5%)
35–44	20 (0.1%)	4	0	2,356 (9.1%)	220 (0.8%)	13	64 (0.2%)	2	0	2,679 (10.3%)
45–54	9	4	0	3,552 (13.7%)	256 (1.0%)	24 (0.1%)	127 (0.5%)	1	0	3,973 (15.3%)
55–64	11	0	0	3,467 (13.3%)	145 (0.6%)	12	171 (0.7%)	3	1	3,810 (14.6%)
65–74	7	1	0	2,053 (7.9%)	124 (0.5%)	7	119 (0.5%)	4	0	2,315 (8.9%)
75–84	1	0	0	492 (1.9%)	47 (0.2%)	2	45 (0.2%)	0	0	587 (2.3%)
85 plus	0	0	0	32 (0.1%)	9	0	2	0	0	43 (0.2%)
Unknown	0	0	0	2	0	0	0	0	0	2 (0%)
Totals	6,517 (25.0%)	808 (3.1%)	29 (0.1%)	16,602 (63.8%)	1,303 (5.0%)	76 (0.3%)	665 (2.6%)	20 (0.1%)	1 (0%)	26,021 (100%)

Source: HES data 1995/96.

Table 12: Numbers (%) of ordinary admissions for inguinal hernia repair, by age and gender.

Age band in years	Simple excision of hernia sac			Primary inguinal repair			Recurrent inguinal repair			Totals
	Male	Female	Unclassified	Male	Female	Unclassified	Male	Female	Unclassified	
0–4	3,038 (4.9%)	278 (0.5%)	194 (0.3%)	716 (1.2%)	72 (0.1%)	10	33 (0.1%)	3	3	4,347 (7.1%)
5–14	967 (1.6%)	123 (0.2%)	74 (0.1%)	244 (0.4%)	39 (0.1%)	4	20	2	0	1,473 (2.4%)
15–24	89 (0.1%)	6	5	1,340 (2.2%)	59 (0.1%)	32 (0.1%)	47 (0.1%)	3	0	1,581 (2.6%)
25–34	33 (0.1%)	10	1	2,676 (4.3%)	174 (0.3%)	74 (0.1%)	132 (0.2%)	9	5	3,114 (5.1%)
35–44	24	5	0	3,240 (5.3%)	306 (0.5%)	69 (0.1%)	237 (0.4%)	13	7	3,901 (6.3%)
45–54	49 (0.1%)	6	2	6,339 (10.3%)	483 (0.8%)	154 (0.3%)	642 (1.0%)	28	16	7,719 (12.5%)
55–64	82 (0.1%)	6	7	9,575 (15.5%)	478 (0.8%)	207 (0.3%)	1,137 (1.8%)	28	12	11,532 (18.7%)
65–74	80 (0.1%)	16	3	12,333 (20.0%)	900 (1.5%)	206 (0.3%)	1,747 (2.8%)	29	23	15,337 (24.9%)
75–84	66 (0.1%)	11	8	8,049 (13.1%)	1,019 (1.7%)	156 (0.3%)	1,185 (1.9%)	37	18	10,549 (17.1%)
85 plus	9	3	2	1,488 (2.4%)	328 (0.5%)	18	208 (0.3%)	14	4	2,074 (3.4%)
Unknown	0	0	0	3	0	0	0	0	0	3 (0%)
Totals	4,437 (7.2%)	464 (0.8%)	296 (0.5%)	46,003 (74.6%)	3,858 (6.3%)	930 (1.5%)	5,388 (8.7%)	166 (0.3%)	88 (0.1%)	61,630 (100%)

Source: HES data 1995/96.

Femoral hernia repair

As with inguinal hernia, the percentage of operations performed as day cases has increased (Figure 8), although femoral hernia operations are much less likely to be performed as day cases than are inguinal hernia, in part because a much higher percentage of operations are done as emergencies. Recurrent repairs are less likely to be performed as day cases than are primary repairs. Day-case surgery becomes less common with increasing age (Figure 9).

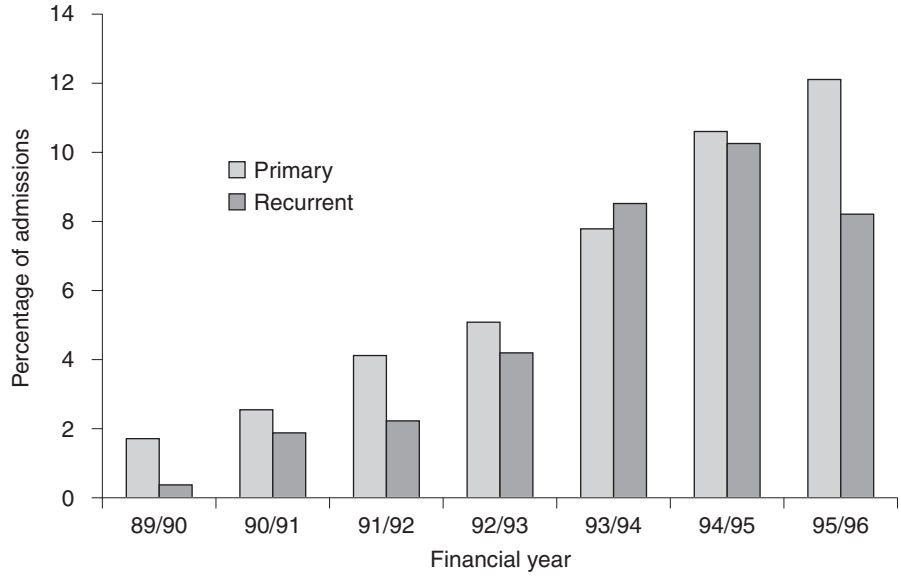

Figure 8: Trends in the percentage of admissions for femoral hernia classified as day cases. *Source*: HES data 1995/96.

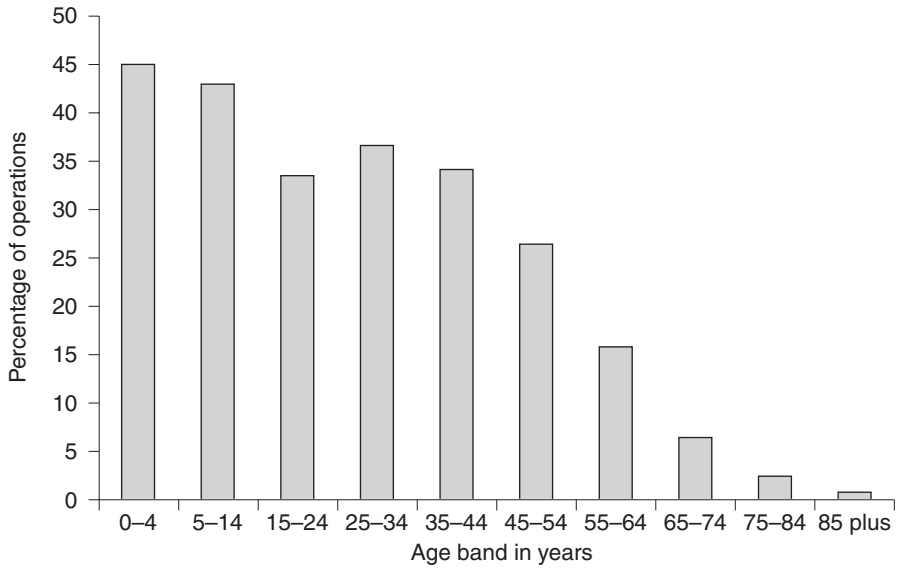

Figure 9: Percentage of femoral hernia operations performed as day cases, by age. *Source*: HES data 1995/96.

In the financial year 1995/96, 12.1% of primary repairs and 8.2% of recurrent repairs were performed as day cases. For primary and recurrent repairs combined, 11.9% of procedures were performed as day cases. In the same year, there were 2807 elective femoral hernia repairs. Of these, only 613 (21.8%) were done as day cases. 52.1% of elective repairs were in people aged under 65 years and 76.2% in people aged under 75 years. If all elective surgery in those under 65 years were done as day cases, there would be a 139% rise in day-case surgery. If all surgery in those under 75 years were done as day cases, there would be a 249% rise in day-case surgery.

The numbers of procedures performed as day cases and as ordinary admissions, by age and gender, are set out in Tables 13 and 14.

Table 13: Numbers of admissions classified as day cases for femoral hernia repair in England.

Age band in years	Primary repair			Recurrent repair			Totals
	Unclassified	Male	Female	Unclassified	Male	Female	
0–4		6	3		1	1	1
15–14	0	13	16	0	2	2	33
15–24	1	8	26	0	0	1	36
25–34	2	35	93	0	1	1	132
35–44	4	43	177	0	4	8	236
45–54	6	126	276	0	5	15	428
55–64	12	228	308	0	14	11	573
65–74	25	366	712	0	24	28	1,155
75–84	14	360	870	0	19	23	1,286
85 plus	5	118	500	0	2	17	642
Not known			1				1
Totals	69	1,303	2,982	0	72	107	4,533

Source: HES data 1995/96.

Table 14: Numbers of ordinary admissions for femoral hernia repair in England.

Age band in years	Primary repair			Recurrent repair			Totals
	Unclassified	Male	Female	Unclassified	Male	Female	
0–4	0	4	5	0	0	0	9
5–14	0	15	9	0	1	0	25
15–24	0	12	6	0	0	0	18
25–34	0	17	58	0	0	1	76
35–44	1	10	106	0	1	3	121
45–54	1	33	116	1	3	3	157
55–64	0	39	65	0	0	0	104
65–74	0	29	44	0	1	1	75
75–84	0	9	17	0	1	0	27
85 plus	0	0	1	0	0	0	1
Totals	2	168	427	1	7	8	613

Source: HES data 1995/96.

Length of stay

Inguinal hernia repair

Length of stay for those admitted has fallen gradually over the last 7 years. These trends are demonstrated in Figures 10 and 11. For some procedures the median length of stay was 0 because of the large numbers done as day cases.

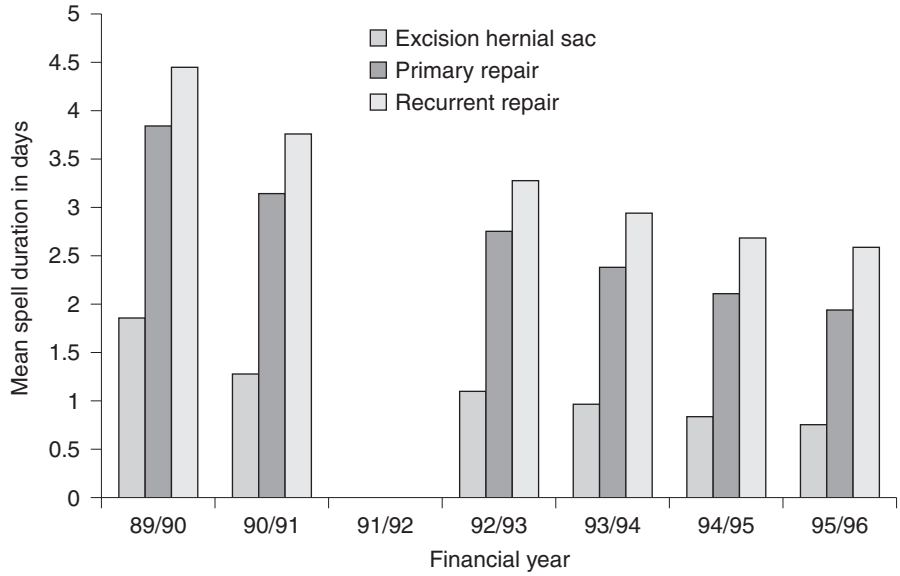

Figure 10: Trend in mean length of stay for inguinal hernia repair.
Source: HES data 1989/90–1995/96.

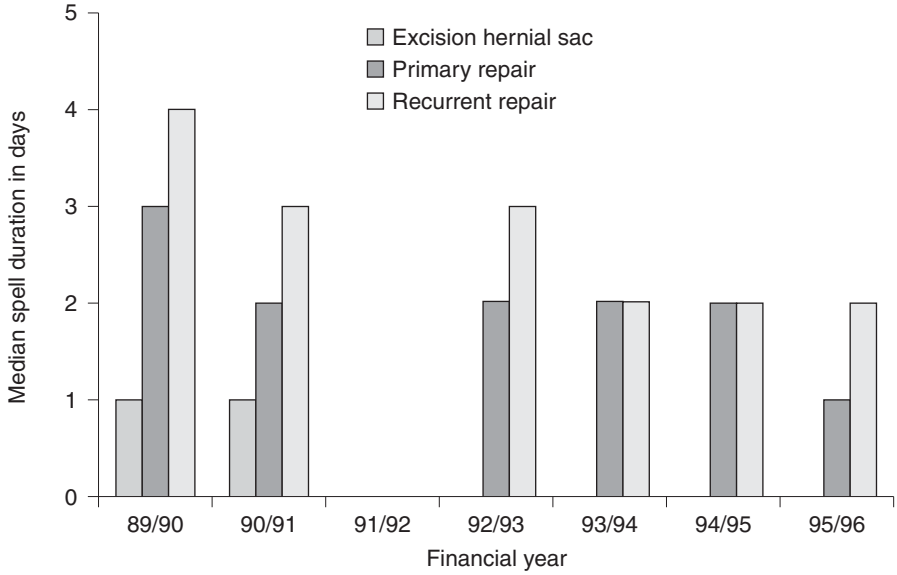

Figure 11: Trend in median length of stay for inguinal hernia repair.
Source: HES data 1989/90–1995/96.

The average length of stay is affected by the increasing numbers of day cases. Table 15 shows the average length of stay for ordinary admissions for 1995/96.

Table 15: Average length of stay for inguinal hernia procedures, excluding day cases.

Procedure type	Excision of hernia sac	Primary inguinal repair	Recurrent inguinal repair	All
Mean spell duration in days	2.5	2.7	3.0	2.7
Median spell duration in days	1	2	2	2

Source: HES data, 1995/96.

Femoral hernia repair

Length of stay for femoral hernia repair has fallen steadily (Figures 12 and 13, *see* overleaf). The median length of stay for primary and recurrent repair was 2 days in 1995/96. The mean length of stay was 4.2 days for primary repair and 3.2 days for recurrent repair.

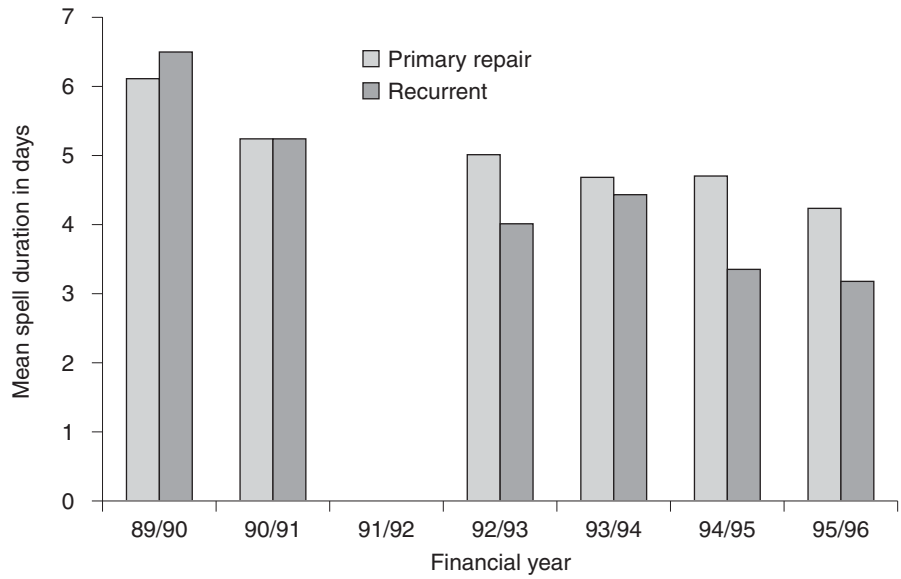

Figure 12: Trends in mean length of stay for femoral hernia repair.
Source: HES data 1989/90–1995/96.

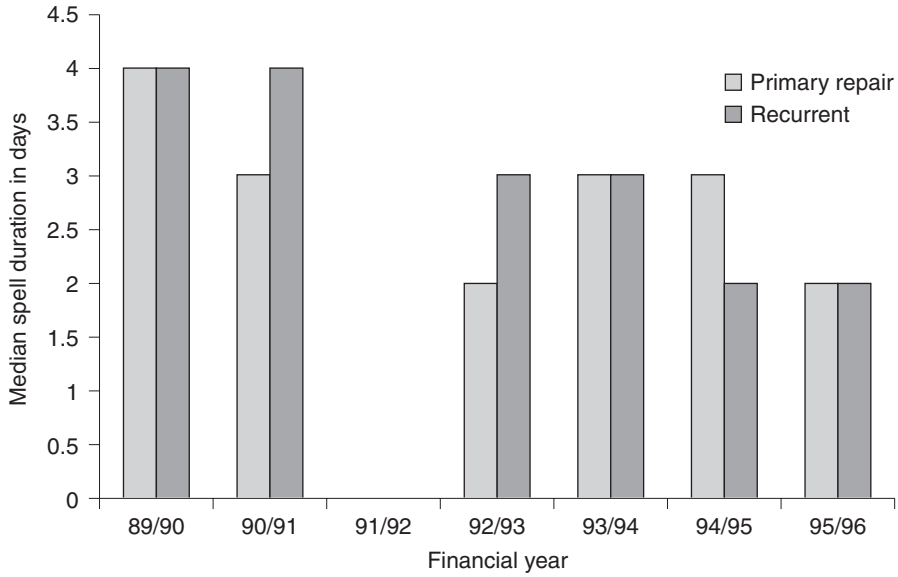

Figure 13: Trends in median length of stay for femoral hernia repair.
Source: HES data 1989/90–1995/96.

When day cases are excluded, the length of stay is longer. The average lengths of stay for 1995/96 are summarised in Table 16.

Table 16: Average length of stay for ordinary admissions in England.

Procedure type	Primary repair	Recurrent repair	All repairs
Mean spell duration in days	5.0	3.6	4.9
Median spell duration in days	3	2	3

Source: HES data 1995/96.

The length of stay for primary repair is longer than for recurrent repair. This is presumably because a higher number of primary repairs are performed as emergencies.

Recurrence rates

Hernia recurrence was included in the high-level performance indicators published by the NHS Executive in June 1999. These are published as a directly age-standardised rate: recurrent repair per 100 000 population per annum, based on HES data 1997–98. The rate for England was 11, with rates for health authorities ranging from 2 to 17. These figures are difficult to interpret, relating as they do to several types of hernia. Low rates may reflect a reluctance to undertake repair of recurrent hernia, rather than relating to the success of primary repairs.

Inguinal hernia repair

An approximation of the recurrence rate in England under current practices may be obtained from the percentage of procedures that are for recurrent hernia – in 1995/96, 7.2%.

There has been a steady rise in the percentage of repairs performed for recurrent hernia from the 5.2% seen in 1989/90. It is possible that this represents an increase in the failure rate, but it is perhaps more likely to be a reflection of a greater willingness to operate on recurrent hernia. Whatever the reasons for the rise, it suggests that in routine NHS practice the recurrence rate is nearer to 10% than to the 1% quoted by specialist centres.

Femoral hernia repair

In 1995/96, 3.8% of femoral hernia repairs were for recurrence. There has been a gradual reduction in the proportion of procedures for recurrence from the 5.7% seen in 1989/90.

Emergency repair

Inguinal hernia repair

The percentage of admissions for inguinal hernia that are classified as emergencies has fallen from 9.1% in 1989/90 to 6.0% in 1995/96. This trend is statistically significant ($p < 0.0001$ using the chi-squared test for trend). In 1995/96, 6.0% of admissions were classified as emergencies. 5.9% of primary repairs and 7.4% of recurrent repairs were classified as emergency admissions. One of the main objectives in undertaking hernia repair is to prevent obstruction and strangulation. This should lead to a fall in emergency admissions. Numbers of admissions by admission method are summarised in Table 17.

Table 17: Numbers (%) of inguinal hernia repairs, by admission method.

Admission method	Gender	Excision of inguinal sac	Primary repair	Recurrent repair	Totals
Elective	Male	9,702 (11.1%)	59,312 (67.7%)	5,608 (6.4%)	74,622 (85.1%)
	Female	1,166 (1.3%)	4,638 (5.3%)	161 (0.2%)	5,965 (6.8%)
	Unclassified	103 (0.1%)	401 (0.5%)	35	539 (0.6%)
Emergency	Male	940 (1.1%)	3,201 (3.7%)	441 (0.5%)	4,582 (5.2%)
	Female	80 (0.1%)	506 (0.6%)	24	610 (0.7%)
	Unclassified	14	20	5	39
Babies	Male	10	9		19
	Female	1			1
	Unclassified	1			1
Others	Male	302 (0.3%)	83 (0.1%)	4	389 (0.4%)
	Female	25	17	1	43
	Unclassified	207 (0.2%)	585 (0.7%)	49 (0.1%)	841 (1.0%)
Totals		12,551 (14.3%)	68,772 (78.5%)	6,328 (7.2%)	87,651 (100%)

Source: HES data 1995/96.

Femoral hernia repair

There has been a small fall in the percentage of admissions classified as emergencies, from 47.4% in 1989/90 to 43.7% in 1995/96. This trend is statistically significant ($p < 0.0001$ using the chi-squared test for trend). 44.8% of the primary repairs and 23.6% of the recurrent repairs were done as emergencies. In Scottish Health Boards, 47.9% of femoral hernia repairs were done as emergencies.[37] The numbers of admissions by admission method are summarised in Table 18.

Table 18: Numbers (%) of admissions, by admission type.

Admission method	Gender	Primary	Recurrent	Total
Elective	Male	905 (17.6%)	61 (1.2%)	966 (18.8%)
	Female	1,744 (33.9%)	85 (1.7%)	1,829 (35.5%)
	Unclassified	11 (0.2%)	1	12 (0.2%)
Emergency	Male	563 (10.9%)	17 (0.3%)	580 (11.3%)
	Female	1,642 (31.9%)	29 (0.6%)	1,671 (32.5%)
	Unclassified	11 (0.2%)	0	11 (0.2%)
Babies	Male	0	0	0
	Female	0	0	0
	Unclassified	0	0	0
Other	Male	49 (1.0%)	1	50 (1.0%)
	Female	3	1	4
	Unclassified	23 (0.4%)	0	23 (0.4%)
Total		4,951 (96.2%)	195 (3.8%)	5,146 (100%)

Source: HES data 1995/96.

A woman is more likely to be admitted as an emergency for a femoral hernia repair than is a man. This may be because women are less likely to present to their GPs with groin swellings, are less likely to be referred for surgery or have to wait longer than men, or because femoral hernia in women is more likely to incarcerate or strangulate. There is some supporting evidence for the first of these explanations from the demand-incidence data in general practice (*see* Section 4).

Waiting times

Inguinal hernia repair

The length of wait has increased steadily over the seven-year period examined (Figure 14, *see* overleaf). For inguinal hernia repairs in England in 1995/96, there was a mean wait of 133 days and a median wait of 85 days. For people unable to work as a consequence of their hernia, this length of wait is unacceptable. The median wait in Scotland for inguinal hernia for 1993 was somewhat less, at 56 days.[37]

There are marked variations in waiting times between different health authorities (Figures 15, *see* overleaf, and 16 and 17 on page 698), with a two-fold difference between the best and the worst.

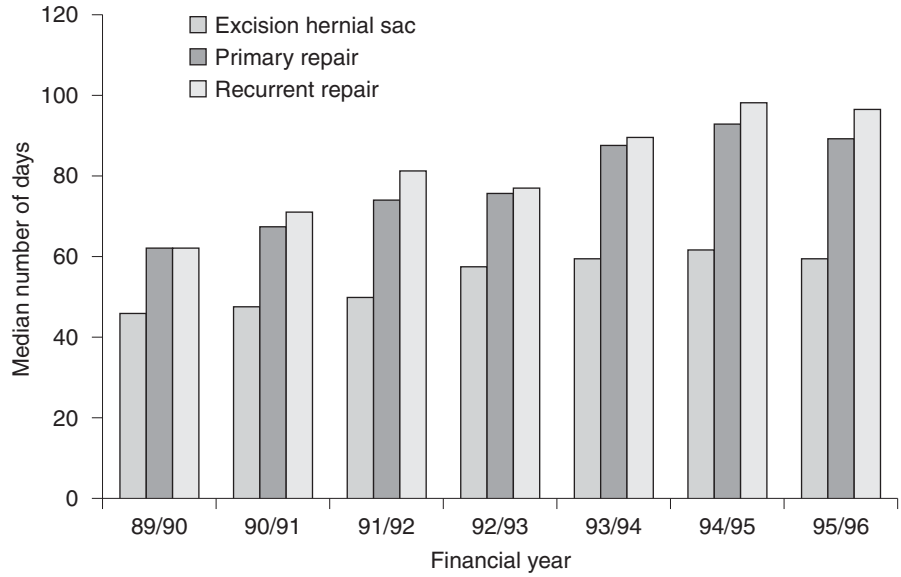

Figure 14: Trends in median length of wait for inguinal hernia repairs.
Source: HES data, 1989/90–1995/96.

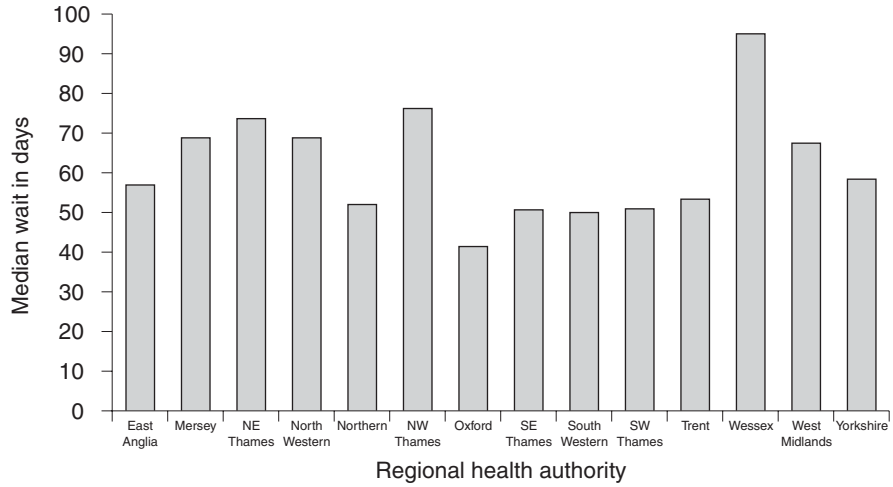

Figure 15: Regional variation in waiting times for excision of the hernial sac.
Source: HES data 1995/96.

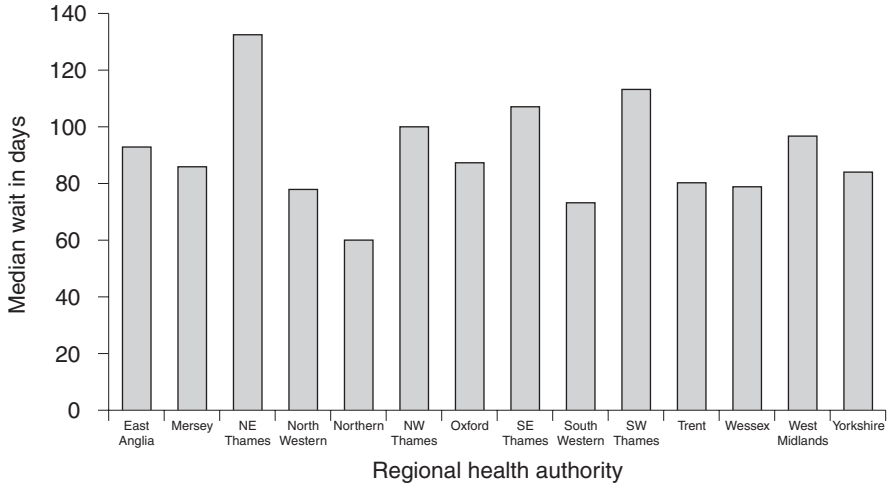

Figure 16: Regional variation in waiting times for primary inguinal hernia repair.
Source: HES data 1995/96.

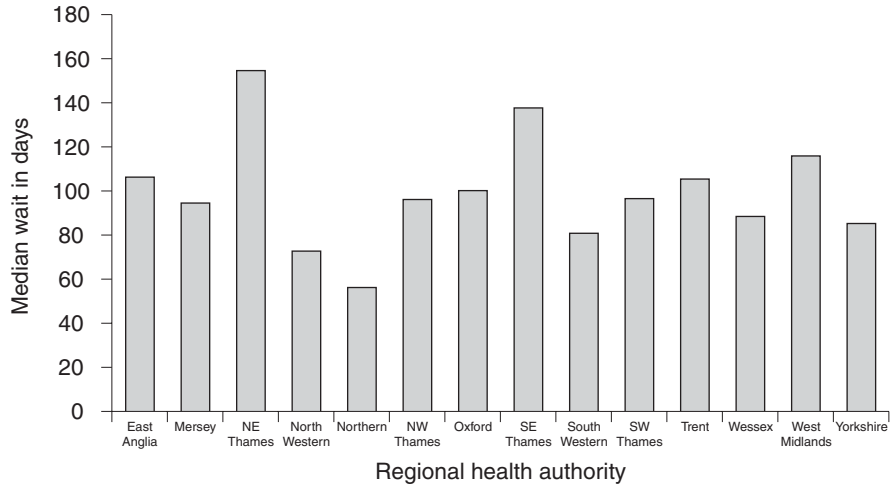

Figure 17: Regional variation in waiting times for recurrent inguinal hernia repair.
Source: HES data 1995/96.

Femoral hernia repair

Waiting times for femoral hernia have also risen steadily over the 7-year period examined (Figure 18). This, combined with the static numbers of operations being performed (*see* 'Volume of surgery' in Section 4), suggests that the referral rate for surgery has increased. For the financial year 1995/96, the median wait for femoral hernia repair was 47 days, with a mean wait of 91.5 days. In Scotland in 1993, the median wait was 40 days.[37]

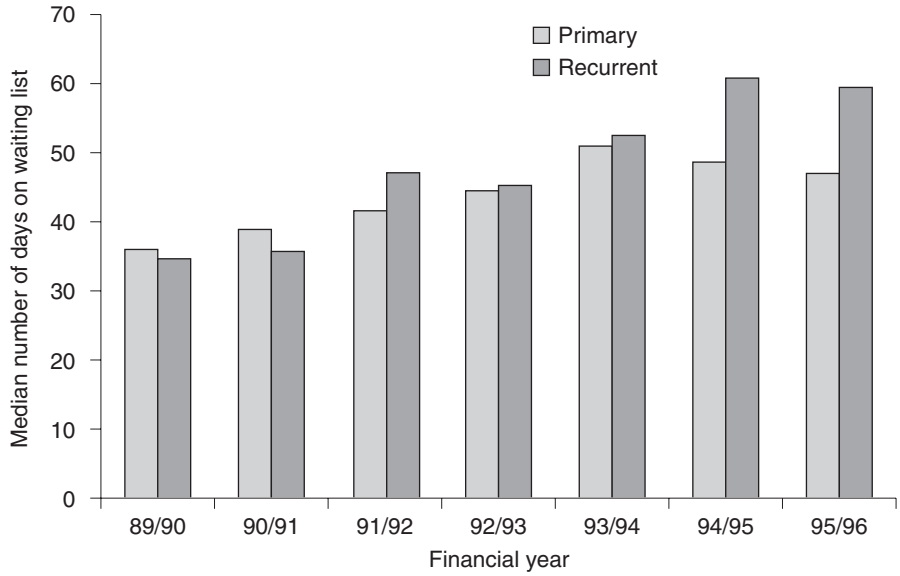

Figure 18: Trends in median length of wait for femoral hernia repair.
Source: HES data, 1989/90–1995/96.

Marked variations in waiting times are observed between different regional health authorities (Figures 19, and 20 overleaf), with as much as a six-fold difference between the best and the worst.

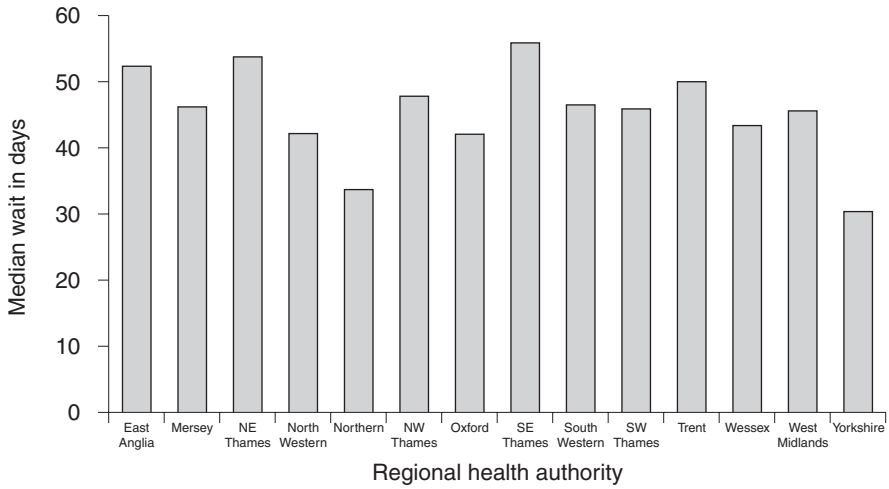

Figure 19: Regional variation in waiting times for primary femoral hernia repair.
Source: HES data 1995/96.

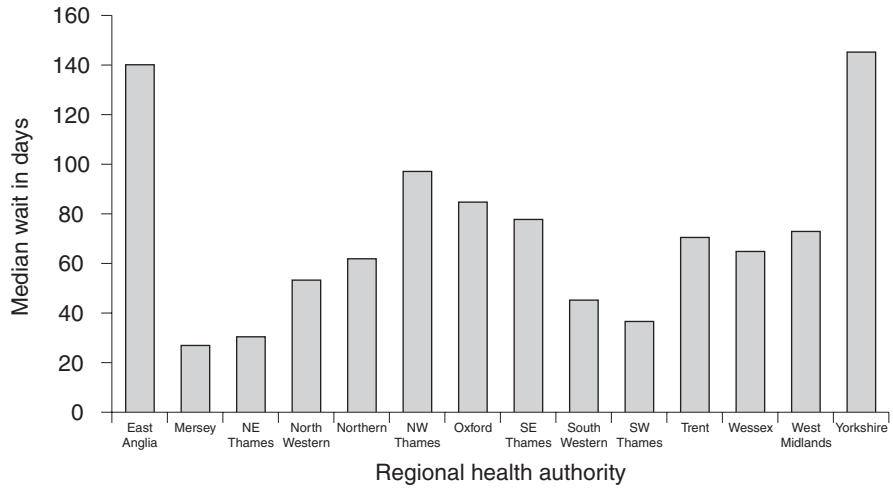

Figure 20: Regional variation in waiting times for recurrent femoral hernia repair.
Source: HES data 1995/96.

Activity in the private sector

Data on privately funded procedures are not widely available. However, the Medical Care Research Unit at Sheffield University surveyed independent hospitals in England and Wales in three separate years.[38,39] The 1992/93 survey was sent to 217 independent hospitals in England and Wales, 93% of whom replied. The Unit used the results to estimate the numbers of procedures carried out. The results for abdominal hernia are summarised in Table 19.

Table 19: Numbers of abdominal hernia repairs in independently funded hospitals in England and Wales.

Year of survey	1981	1986	1992/3
Number of procedures	9,435	15,664	16,444

Source: MCRU, University of Sheffield 1992/93.

For the financial year 1992/93, abdominal hernia repairs comprised 2.4% of the private procedure workload. The majority of abdominal hernia repairs are likely to be for groin hernia. There was an increase of 65% in abdominal hernia repairs between 1981 and 1986 and an increase of only 5% between 1986 and 1992/3. This contrasts with an overall increase in the number of private operations of 67% between 1981 and 1986 and 42% between 1986 and 1992/93. Using incidence data on abdominal hernia from the GP morbidity survey GPMS3,[14] 49% of abdominal hernia presenting in general practice were groin hernia. Allowing for this and correcting for the fact that the independent hospital data relate to England and Wales, we would expect 7606 privately funded operations in the UK per year. This is equivalent to 15.5 per PCG of 100 000. In the GP morbidity survey,[14] 5.6% of outpatient referrals for abdominal hernia were to

the private sector. Applying this to the number of expected new cases of groin hernia (263 – *see* Section 4), we would expect 14.7 referrals per PCG of 100 000. These two estimates, calculated in different ways, are very close, which helps to validate the estimate.

Unfortunately, there are no data more recent than 1992/93 concerning levels of service provision in the private sector. There has been an underlying trend of increasing activity in the private sector, and a recently established specialised hernia repair centre (the British Hernia Centre) appears to be flourishing. They have reported results on thousands of patients.[40] This, along with increasing waiting times in the NHS and anecdotal reports of employers who are willing to pay for procedures for their own staff to avoid long periods of sick pay, suggests that numbers will have continued to rise. From the limited data available, it appears that there has been a greater percentage increase in the number of operations in the private sector than in the NHS, so that private patients may well be referred more frequently than the 5% seen in 1981/82.

Cost of service provision

The costs involved in the treatment of groin hernia are presented in Table 20. Some of these are charges (e.g. ECR charges) and as such will not necessarily be an estimate of the true cost. The actual price paid by a purchaser will often be lower when the service is included in a block contract.

Table 20: Costs and sources for groin hernia services.

Item	Unit cost	Source of cost data
Private day-case surgery. Price includes assessment and follow-up	£895	Informal enquiry to the London Hernia Centre in 1998 for a simple inguinal hernia repair in a fit 45-year-old man
Private GP consultation	£36	Medi Centre charge for consultation lasting up to 15 minutes. September 1998.
Inpatient groin hernia repair	£814	HRG H73/H74 (inguinal or femoral hernia repair in a patient aged under 70 years without complications). Average ECR cost for West Midlands trusts, 1998/99
Day-case groin hernia repair	£488	HRG H73/H74 (inguinal or femoral hernia repair in a patient aged under 70 years without complications). Average ECR cost for West Midlands trusts, 1998/99
Outpatient appointment, first visit	£73	Average ECR cost for West Midlands trusts, 1998/99
Outpatient appointment, follow-up	£41	Average ECR cost for West Midlands trusts, 1998/99
General practitioner consultation Practice nurse consultation Practice nurse procedure	£14 £6 £6	Estimates from PSSRU at the University of Kent, based on 1996/97 prices[41]
Truss prescription	£16	Prescription Pricing Authority data for 1997/98. Mean cost of groin truss

Modelling the cost of groin hernia service provision in a PCG

These models are derived from data on existing service provision *and not on a desired model of care*. The model has been kept as simple as possible. It does not include the option of referral and conservative treatment, because there are no data on which to estimate likely numbers for this scenario. In practice, those who are prescribed trusses will require repeat prescriptions and assessments over the years. Data on truss use were based on numbers of prescriptions rather than on numbers of patients, so this will account for the annual expenditure on truss assessments and prescriptions. The majority of expenditure is on surgery.

Assumptions

Only NHS costs have been considered.

- 73% of inguinal hernia and 64% of femoral hernia presenting to general practice are operated on in the NHS.
- 29.7% of inguinal hernia repairs and 11.9% of femoral hernia repairs are performed as day-case procedures.
- 15 groin hernia presenting to a PCG are referred to the private sector (*see* above).
- A patient having inpatient surgery requires two GP appointments, one outpatient (new) appointment and one practice-nurse appointment.
- A patient having private surgery requires one GP appointment and one practice-nurse appointment (assuming a day-case procedure), as prices quoted usually include assessment and one follow-up visit.
- A patient having day-case surgery requires two GP appointments, one outpatient appointment (new) and two practice-nurse appointments.
- A patient having conservative treatment requires two GP appointments, and 55% will be prescribed a truss (based on PPA data).
- 29.7% of inguinal hernia and 11.9% of femoral hernia repairs are performed as day cases.
- Numbers are based on a PCG of 100 000 with the population structure of England.

For a PCG of 100 000 patients, in each year there would be 247 new referrals with inguinal hernia and 16 referrals with femoral hernia. Of the 247 inguinal hernia, 14 would be referred to the private sector, 180 would be operated on in the NHS and 53 would be treated conservatively. Of the NHS operations, 53 would be done as day cases and 127 as inpatient procedures. Of the 16 femoral hernia repairs, 5 would be treated conservatively, 1 would be referred to the private sector and 10 would be operated on in the NHS. Of the NHS operations, 1 would be done as a day case and 9 would be done as inpatient procedures. (*See* flowchart.)

NHS costs associated with private surgery

15 episodes each requiring one GP appointment and one practice-nurse appointment.

Total £300

NHS costs for inpatient surgery

136 episodes each requiring two GP appointments, one new outpatient appointment, one surgical inpatient procedure and one practice-nurse appointment.

Total £125 256

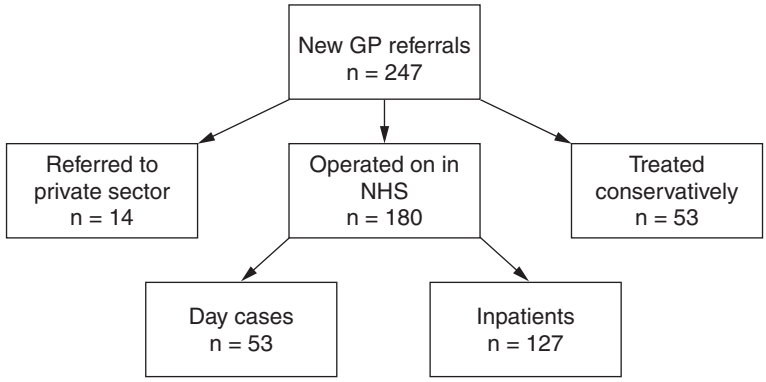

Figure 21: Inguinal hernia: modelling patient flows.

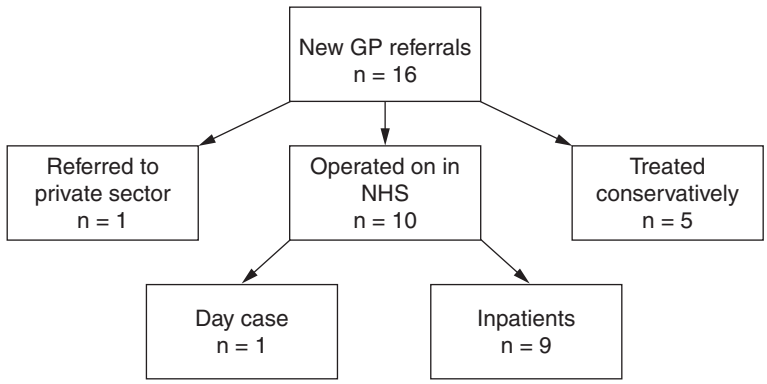

Figure 22: Femoral hernia; modelling patient flows. (Conservative treatment for femorial hernia is not recommended, but in practice some patients may decline surgery and others are not being offered surgery.)

NHS costs for day-case surgery

54 episodes each requiring two GP appointments, one new outpatient appointment, one surgical day-case procedure and two practice-nurse appointments.

Total £32,454

NHS costs for conservative treatment

58 episodes each requiring two GP appointments. 32 episodes requiring truss prescription.

Total £2136

Total annual NHS costs

The estimated total annual NHS costs of treatment for hernia for a PCG of 100 000 patients is £160 000.

6 Effectiveness and cost-effectiveness of services

Appropriateness of treatment

The aims of hernia treatment are threefold:

- to eliminate the risk of incarceration or strangulation
- to provide symptomatic relief of groin pain and discomfort
- to give the cosmetic benefit of removing groin swelling.

There is no trial that compares surgery for groin hernia with no treatment or with conservative treatment (i.e. trusses). Research is dominated by outcome studies of inguinal hernia repair, by measurement of recurrence rates and by trials comparing different methods of inguinal hernia repair. Corresponding data for femoral hernia are sparse.

There is a consensus among surgeons that surgery is the treatment of choice in children and in patients with femoral hernia. This is because the lifetime risk of obstruction or strangulation is higher in these two groups of patients. The Royal College guidelines published in 1992 advised that a small direct hernia in an elderly person might be best left untreated.[42] However, the distinction between a direct and an indirect hernia is not easily made clinically, with an accuracy of only 69%.[25]

The effectiveness of surgery is usually measured in terms of recurrence rate, recovery period or return to work, and complications. Unfortunately there is no standard definition of a 'recurrence'. The reported recurrence rate in any series may depend on the procedure used, the skill of the operator, the length of follow-up and the method of identifying recurrences – e.g. regular review by a clinician versus self-reporting. There are few studies that look at quality of life before and after surgery.

Surgery is certainly effective in that it offers a cure for the anatomical defect in most people. Evaluation of the quality of life before and after hernia surgery has also demonstrated significant reduction in pain and improvement in function.[4]

Reported recurrence rates for groin hernia repair vary enormously.[43] There has been a general trend for recurrence rates to fall over time, and specialist centres publish very low recurrence rates. The British Hernia Centre claims a recurrence rate of less than 1% over follow-up of one-and-a-half to five years.[40,44] The Shouldice Centre and the Lichtenstein Centre quote similarly low recurrence rates.[33,45] This is probably due in part to the skill and expertise of the dedicated hernia surgeons, but there are also some claims that it is a result of their chosen method.[33] Other series quote recurrence rates for inguinal hernia repair of between 0.7% and 14.3%.[21] Failure of recurrent inguinal hernia repair may be as high as 30%.[46]

In his review of 2105 femoral hernia repairs, Glassow found recurrence rates of 2% for primary repairs and 7–10% for recurrent repairs.[47] A Spanish series of 93 femoral hernia repairs (using the Lichtenstein technique), with follow-up ranging from 2 to 4 years, reports 1 recurrence in 93 repairs (recurrence rate 1.1%).[48]

Scottish Health Boards report a recurrence rate of 1% for inguinal hernia and 0.5% for femoral hernia over a 2-year follow-up period,[37] but it is not clear how recurrence has been defined. If the figures have been derived from routine data sources, they are likely to be an under estimate.

In the USA, approximately 10% of all hernia repairs are for recurrent hernia.[49] The equivalent figure for England, using 1995/96 HES data, is 7.2%. These figures will under estimate the true recurrence rate, as they are dependent on the diagnosis and on referral for recurrent repair.

Differences in case-mix are unlikely to account for the large differences in outcome between these overall rates and those quoted by specialist centres. The average age of men operated on at the British Hernia Centre is lower than for those operated on in the NHS. However, the British Hernia Centre does operate on elderly patients and on patients with a variety of manual and sedentary occupations.[40] They are

also happy to operate on patients with large or difficult hernia. Twenty per cent of groin hernia procedures performed at the British Hernia Centre were for large scrotal hernia.[40]

The quality of the available evidence on the effectiveness of interventions (*see* Appendix II) is set out in Table 21.

Table 21: Quality grading of evidence.

Intervention	Size of effect	Quality of evidence
Surgery for femoral hernia	A	III
Truss for femoral hernia	E	IV
Surgery for inguinal hernia	B	III
Truss for inguinal hernia	C	III
Conservative treatment for small direct hernia	B	III
Specialist (hernia unit) care	B	II
Laparoscopic surgery versus open surgery	C	I

A good-quality systematic review of hernia surgery was published in 1998.[50] It sought to answer six questions in relation to groin hernia repair. The authors' conclusions are summarised in Table 22. The

Table 22: Summary of conclusions of systematic review by Cheek *et al.*[50]

Research question	Conclusions
Is local anaesthesia (LA) a safe and effective alternative to general anaesthesia?	LA has fewer adverse effects on respiratory function than does general or regional anaesthesia. Procedures are shorter under LA and outcomes appear to be equivalent.
Is there a difference in outcome between specialist and non-specialist surgeons?	Large series from specialist centres demonstrate low recurrence rates. There are no trials comparing specialist against non-specialist results. Rigorous studies are required.
Is day-case procedure as safe and effective as inpatient surgery?	There is no evidence that outcomes differ between day-case procedures and inpatient surgery. Studies with longer follow-up periods are required to assess the recurrence rate.
Is synchronous bilateral hernia repair as safe and effective as delayed repair?	There was insufficient evidence to reach a conclusion.
Which method of surgery is the safest and most effective for inguinal hernia repair?	Laparoscopic repair is superior to open surgery in terms of post-operative pain and time to return to work. Recurrence rates and wound infections do not appear to differ. The Shouldice repair appeared to result in fewer recurrences than do other suture methods. Open mesh repairs may result in less post-operative pain and lead to faster recovery than with the Shouldice repair. It is difficult to draw conclusions on the choice of laparoscopic technique. A totally extra-peritoneal approach may have better outcomes than other laparoscopic methods.
Which method is the safest and most effective for femoral hernia repair?	Unable to draw any conclusions, as the literature was so poor.

literature searching for this review was completed in February 1996. The bulk of new research since this time concerns the use of laparoscopic methods for inguinal hernia repair.

These issues are discussed in more detail in the next section. The discussion relates entirely to inguinal hernia repair because of the paucity of published data on femoral repair.

Anaesthetic alternatives

General, regional (epidural or spinal) and local anaesthesia may all be used for hernia repair. Laparoscopic hernia repair is only possible under general anaesthesia. For open surgery, local anaesthesia is an option, provided that the hernia is reducible and the patient not obese. Operating under local infiltration anaesthesia does enable the patient to demonstrate the hernia during the operation and to test the repair by straining. These are small advantages to the surgeon, of no real consequence. There is no evidence to support local or general anaesthesia in the early post-operative period or later in terms of return to work. Some patients may have contraindications to general anaesthesia,[51–53] while others will refuse a local anaesthetic.[53] It is also easier to organise day-case surgery when there is no requirement for general anaesthetic administration because patients may be discharged home almost immediately.

Specialist versus non-specialist care

Open repair of an inguinal hernia is a procedure learned early by surgeons in training but performed variably. Technical difficulties are minimised by the mesh technique. By contrast the Shouldice repair is demanding and requires a considerable apprenticeship. The Shouldice Clinic in Canada requires staff members to perform 100 procedures as assistants before allowing them to embark alone.[40] Laparoscopic techniques are most demanding of all and at present are carried out only by surgeons with a special interest in minimal-access surgery. During the learning curve, operation times are longer and the surgeon may have to convert to an open technique. This applied to surgeons who had considerable experience of minimal-access surgery in other areas.[54]

There have been no randomised trials comparing treatment at a specialist centre with 'routine' care, although published recurrence rates are lower from specialist centres. A cohort study undertaken in the USA demonstrated better outcomes in patients treated by the specialist hernia team than in those given routine care by general surgeons.[55] Standardisation of care within a general setting may offer benefits.[56]

The choice between day-case and inpatient care

Day-case treatment costs less and has the practical advantage that the procedure is less likely to be cancelled because of the lack of a bed. There are no other advantages in terms of outcome to the patient. There has been a long history of day-case surgery; a Scottish surgeon performed nearly 500 outpatient inguinal hernia repairs in 1955[57], but others have been slow to follow.

The percentage of patients receiving day-case repair is rising year on year as surgeons and patients gain confidence. Inevitably some patients are excluded by the day-case selection criteria. For example, patients undergoing bilateral hernia repair are not appropriate. In general it is the older patient who is likely to be excluded, either through an escalating ASA (American Society of Anaesthetist) grade or through social isolation. In contrast, the British Hernia Centre and the Shouldice Centre undertake the majority of repairs as day cases, even in the very elderly. Presumably patients will not present for surgery if they are unable to make arrangements for their aftercare.

Choice of surgical technique

Comparing the Shouldice repair with the Lichtenstein mesh repair for inguinal hernia, Cheek *et al.*[50] concluded that the two techniques are equivalent, stating that 'neither procedure appears to have a clear advantage over the other'. Their analysis considers operative morbidity and recurrence rate and is heavily dependent on data from randomised, controlled studies.

When the Shouldice technique is compared with open sutured repairs (Maloney darn) based upon the evidence of randomised studies with 2-year follow-up, the Shouldice repair is superior with 'a clear difference' in recurrence rate at 2 years.[50] Cheek *et al* were unable to make any comparison between mesh repair and sutured repair because 'a paucity of studies meant no conclusions can be drawn'.

Laparoscopic repair of inguinal hernia is the most recently developed surgical technique. It offers a radical new approach, but there are, as yet, no definitive conclusions regarding its use. Laparoscopic repair is suitable for reducible hernia, either primary or recurrent. Fewer surgeons are competent to perform laparoscopic repair, whereas an open repair is within the repertoire of all trained general surgeons. The laparoscopic repair has distinct advantages when dealing with a recurrent hernia. It is probably the preferred, if more expensive, choice when the failure follows original surgery by an open method.[58]

There have been numerous controlled trials since Cheek *et al.* undertook their systematic review. These trials confirm that laparoscopic surgery takes longer than open repair but that recovery time is shorter.[58–75] Recovery has been measured in terms of time to return to work or to normal activities, global quality of life using SF36, and severity and extent of post-operative pain.

Two large multi-centre studies have looked at complications and recurrence rate.[45,70] A large such study by the MRC, comparing laparoscopic repair with open hernia repairs (predominantly mesh repairs),[45] found that patients in the laparoscopic group recovered more quickly but that all recurrences and serious surgical complications occurred in this group. However, the major complications occurred in relation to a trans-abdominal technique, which is being superseded by an extra-peritoneal technique. Another large multi-centre trial found laparoscopic surgery to be safer than a conventional open approach, but in this study extra-peritoneal approaches were used.[70] There is an ongoing debate over the costs and benefits of laparoscopic hernia repair and as yet no consensus has been reached.[76] The EU Hernia Trialists Collaboration has registered a systematic review of laparoscopic versus open hernia repair with the Cochrane Collaboration.[77]

Prolonged follow-up is desirable when assessing recurrence rates, as over 50% of recurrences occur four or more years after surgery.[21,46] Reported results from randomised controlled trials rarely extend this far.

A recent survey in the West Midlands found that laparoscopic techniques were used in only 35% of the units undertaking groin hernia repair. In each centre, only one or two members of surgical staff would undertake laparoscopic repair, so that only a small proportion of repairs were performed laparoscopically. Mesh repairs were common to all units, and 70% performed some form of open suture technique.[78] In the US, more than 80% of repairs involve a mesh prosthesis and are completed as outpatients.[79]

Economic issues

There is one cost-effectiveness study comparing surgery with conservative treatment for groin hernia. Neuhauser modelled elective surgery against the provision of a truss in the elderly (65 years and over). He found no survival benefit from elective surgery in this group of patients.[26] Even assuming a perfect surgeon (where there were no recurrences and no mortality from elective surgery), although there was then a survival benefit, the cost per life-year gained was high. There are two main problems with this study. Firstly, the estimates of the annual risk of strangulation may not have been appropriate; secondly, no

account was taken of the quality of life in either group. In addition, it is important to remember that the calculations would be different in a younger group who would stand to lose more of their life expectancy if they died from a complication.

It is impossible from the data available to assess the level of need for hernia repair accurately. There are no good risk estimates for strangulation or incarceration. Neither do we know whether people are offered an operation principally to reduce the risk of complications and premature death, to relieve symptoms or for cosmetic benefit.

People in manual occupations may be on sick leave for prolonged periods of time waiting for a hernia repair, with considerable cost to the individuals, their employers and the welfare state. If 1% of people waiting for an inguinal hernia repair are unable to work while waiting, with a mean wait of 133 days, this is equivalent to 295 lost years of productivity per annum.

Economic studies of different methods of repair have found that laparoscopic surgery is more expensive because of longer operating times, higher equipment costs and the need for overnight hospital stay.[58,80,81] This may be partly offset by the faster recovery of the patient and earlier return to work;[81] however, the additional costs are borne by the health sector, and the cost benefits would be outside the health sector.

The median time to resume 'normal' activities following surgery varies enormously between studies – any time between 1 and 6 weeks.[40] In the UK, patients are routinely given sick notes for 4 to 6 weeks without assessment of the patients' condition or ability to undertake their usual work. In the USA, median time to return to work and period of post-operative pain have been related to the availability of compensation.[82] Specialist centres undertaking open, tension-free repair recommend early mobilisation, and patients return to work after a median of 9 days.[40] An American surgeon describes over 20 000 hernia repairs, all undertaken with local anaesthetic, where patients are advised to mobilise immediately (they climb down from the operating table) and resume normal activities on the same day.[83] Patients who do not mobilise are at increased risk of deep venous thrombosis. While sick leave does not affect health care spending, it does have an effect on overall public spending. Current recommendations for time off work need to be reconsidered.

The cost-effectiveness of surgery can best be improved by reducing recurrence and increasing the proportion of procedures performed as day cases.[49]

7 Quantified models of care and recommendations

Inguinal hernia is a common condition and will continue to require considerable surgical resource to relieve symptoms and prevent life-threatening complications. There is a growing understanding of the laparoscopic approach, which is at least equivalent to the open repair; but it is the latter that will remain the mainstay of treatment for some years to come. There is insufficient expertise in the surgical community to support a change to the laparoscopic alternative except for recurrent hernia. However, it is important that the skills are encouraged if there are local pockets of expertise. Present knowledge would advise repair by experienced surgeons but not necessarily in a specialist centre.

Groin hernia cannot be prevented (although they may be less common in non-smokers) and they tend to increase in size if left. The only effective treatment is surgery. There is a need to identify patients who can probably benefit from surgical intervention and to offer them an efficient service and safe and effective surgery. Many elderly people with an asymptomatic hernia would decline surgery if they felt that their health was not at risk. Unfortunately, it is not possible to give precise estimates of risk to any individual.

The costs of groin hernia may be reduced by increasing day-case surgery, reducing recurrence rates[49] and reducing the time spent off work waiting for or recuperating from surgery. The limiting factor on day-case

surgery may be the lack of social support available for many elderly people, rather than strict medical factors.

We offer these recommendations for improvements in the current provision of service.

- Femoral trusses should not be prescribable on an FP10, as there is no clinical justification for their use.[2]
- Day-case surgery should be maximised, as it will free up hospital beds. Acute care throughput per bed is now higher in the UK than in any other Organisation of Economic Co-operation and Development (OECD) country, and some have argued that the pressure on the acute sector could compromise the quality of care.[84] Charges are much less for day-case surgery than for inpatient surgery, so there is potential for saving costs. More patients are suitable for day-case surgery if local rather than general anaesthetic techniques are used.
- Waiting lists have increased steadily over the past few years. This situation needs to be addressed. It may be sensible to introduce a prioritisation scheme so that those who are incapacitated by their hernia would not have to wait long for surgery. It is reassuring to see that, despite an increase in waiting time for operations, the percentage of inguinal hernia operations performed as emergencies has fallen, without a rise in mortality. There has been a very small decrease in the percentage of femoral hernia operations performed as emergencies, and the mortality rate seems fairly stable.
- Laparoscopic surgery is offered routinely in some centres. The surgery takes longer and is more expensive, and longer-term outcomes are probably equivalent to conventional techniques, but recovery time for the patients appears reduced.[49,50,58] There is a need for capital investment in equipment and investment in training. A move to laparoscopic surgery would increase costs and would put pressure on inpatient beds, because the surgery cannot be performed under local anaesthetic and fewer patients would be suitable for day-case surgery.
- Specialist hernia centres offer better outcomes in terms of recurrence rates than are achieved routinely in the NHS (1% versus 5–10% – *see* the previous section). It is difficult to know whether these results are affected by patient selection, with private clinics more likely to operate on young, fit patients requiring straightforward repairs. The private centres, however, do claim to be successful with recurrent hernia. As a starting point, all trusts should collect data on the outcomes of hernia repair for publication. Scottish Health Boards all publish 2-year outcomes for hernia repair. English trusts and health authorities should be able to do the same.
- Specialist privately funded hernia centres provide a model of hernia repair provision that could be used in the NHS. At the British Hernia Centre, all operations are performed under local anaesthetic and are done as day-case procedures. Surgeons have extensive experience in hernia surgery. It is feasible for the NHS to operate a similar system, as demonstrated by Kingsnorth and colleagues.[56] As several specialist centres[34,40,51] quote equally low recurrence rates despite using different techniques, it implies that recurrence is more related to the skill of the operator than to the actual technique used.
- The Royal College of Surgeons has collected data on 5500 groin hernia repairs as part of their National Groin Hernia Outcomes Project (NGHOP). The results were published in 2001 and give valuable information on recurrence rates following NHS surgery**. [AQ – confirm publication in 2001???]** Open-mesh repairs have largely replaced 'darn' methods, and the majority of procedures are being carried out under the supervision of senior surgeons.[85] These changes may have resulted in improved outcomes from hernia surgery.
- With modern 'tension-free' methods, early mobilisation is encouraged and 1–2 weeks of sick leave should be adequate for most people. General practitioners need revised guidance on recommendations for return to work following hernia repair.

Cost-modelling an increase in day-case surgery

An average PCG with lists totalling 100 000 and the population structure of England would expect 247 new inguinal hernia and 16 new femoral hernia every year (*see* Section 4).

Assumptions:

- All elective hernia repairs in patients under 65 years of age could be done safely as day cases. Potential numbers of day cases are based on the numbers of elective procedures performed in those aged under 65 years.
- Outcomes from day-case surgery are the same as for inpatient surgery.[46]
- Only NHS costs have been considered. The costs used are those outlined in Section 5.
- Patients having day-case surgery would require an extra GP consultation and a practice-nurse consultation.
- Numbers are based on a PCG of 100 000 with the population structure of England.

A PCG would expect to commission 8 elective femoral hernia repairs and 166 elective inguinal hernia repairs per year.

For 1995/96, 21.8% of elective femoral hernia repairs were performed as day cases, but 52.1% of patients were aged under 65 years. Assuming a move from 21.8% day-case surgery to 52.1% day-case surgery, 2 patients would be operated on as day cases instead of as inpatients.

For 1995/96, 32.1% of elective inguinal hernia repairs were performed as day cases, but 65.5% of patients were aged under 65 years. Assuming a move from 32.1% day-case surgery to 65.5% day-case surgery, 56 patients would be operated on as day cases instead of as inpatients.

The total number of patients who would be operated on as day cases instead of as inpatients is therefore 58.

The difference between charges for day-case surgery and for inpatient surgery = £326.

Additional care costs in primary care for day-case surgery = £21.

Therefore the marginal cost saving per hernia repair moved from inpatient care to day-case surgery = £305.

The potential cost saving per PCG per year (for 58 patients) is £17 690.

This calculation assumes that charges are a true estimate of cost and that cost savings can be realised. It does not take into account the cost of developing or expanding a day-case unit, in terms either of building work or of staff training. It is also unlikely that staff costs on inpatient care could be reduced. It is perhaps better to consider the opportunity cost of using inpatient beds unnecessarily when the pressures on beds are considerable.

8 Outcomes, audit methods and targets

Recurrence rates

Recurrence rates of less than 1% at 1–2 years are achievable at specialist hernia centres, and this is the standard we should aim to achieve in the NHS. The definition of recurrence would need to take into account the period of observation and a specific definition of recurrent hernia (e.g. whether to include just those presenting for recurrent repair or whether to invite patients back for clinical assessment). In order to allow comparison, trusts and health authorities should collect and publish recurrence rates for hernia repair in a standardised way, as do Scottish Health Boards.

Wound infection rates and other complications

Complications of groin hernia surgery include:

- wound haematomas
- wound infection
- sinus formation (unusual with modern suture material)
- scrotal complications – e.g. oedema, testicular atrophy
- urinary retention
- medical problems – e.g. myocardial infarct, pulmonary embolism
- death within 28 days of surgery.

Most centres will be unable to quote their complication rates for surgery, apart from death within 28 days. Published series quote very variable rates – for example, wound infection rates of 0.13%–0.6% and sinus formation rates of 0.1%–4.9%.[21] Providers need to develop systems for monitoring complication rates.

9 Information and research priorities

What are the limitations on day-case surgery?

Can hernia at risk of strangulation be predicted?

Some research shows that the risk of strangulation is much higher soon after diagnosis.[23] It also seems to be unusual for femoral hernia to strangulate while a patient is on the waiting list for hernia repair. It may be that those who present for treatment are the ones with long-standing hernia at little risk of strangulation. The percentage of femoral repairs performed as an emergency has changed little over the years at 45%.

If it is so important to operate on some hernia, should we be raising awareness among patients so that they seek medical advice at an early stage?

Can we ever determine the relative cost-effectiveness of repair as against conservative management?

Is there a place for the truss in a modern health service?

This would require an RCT measuring quality of life, comparing a truss with surgery for those at low risk of strangulation. Patients using a truss could be offered surgery at the end of the study period. Waiting times for surgery are already five months, so the study could be organised and would not even introduce a delay. At a minimum, there should be a prospective cohort study examining quality of life issues in truss users.

Are the additional benefits in terms of quality of life following laparoscopic hernia repair worth the additional cost?

Is there a case for specialisation of hernia services?

This would require an RCT comparing, for example, protocol-driven care by general surgeons with operation by members of a specialist team.

Appendix I: Codes

Diagnostic codes

International Classification of Diseases (ICD) IXth revision

Code	Description
550	Inguinal hernia
550.0	Inguinal hernia, with gangrene
550.1	Inguinal hernia, with obstruction, without mention of gangrene
550.9	Inguinal hernia, without mention of obstruction or gangrene
551.0	Femoral hernia, with gangrene
552.0	Femoral hernia, with obstruction, without mention of gangrene
553.0	Femoral hernia, without mention of obstruction or gangrene

International Classification of Diseases (ICD) Xth revision

Code	Description
K40	Inguinal hernia
K40.0	Bilateral inguinal hernia, with obstruction, without gangrene
K40.1	Bilateral inguinal hernia, with gangrene
K40.2	Bilateral inguinal hernia, without obstruction or gangrene
K40.3	Unilateral or unspecified inguinal hernia, with obstruction, without gangrene
K40.4	Unilateral or unspecified inguinal hernia, with gangrene
K40.9	Unilateral or unspecified inguinal hernia, without obstruction or gangrene
K41	Femoral hernia
K41.0	Bilateral femoral hernia, with obstruction, without gangrene
K41.1	Bilateral femoral hernia, with gangrene
K41.2	Bilateral femoral hernia, without obstruction or gangrene
K41.3	Unilateral or unspecified femoral hernia, with obstruction, without gangrene
K41.4	Unilateral or unspecified femoral hernia, with gangrene
K41.9	Unilateral or unspecified femoral hernia, without obstruction or gangrene

READ™ diagnostic codes and their ICD10 equivalents

Read diagnostic code	ICD 10
J3012, Bilat.inguinal hernia + obstruction	K40.0
J3013, Bilat.recur.inguinal hernia + obstruction	K40.0
J3022, Bilat.inguinal hernia – irreducible	K40.0
J3023, Bilat.recur.inguinal hernia – irreducible	K40.0
J3002, Bilat.inguinal hernia + gangrene	K40.1
J3003, Bilat.recur.inguinal hernia + gangrene	K40.1
J3032, Bilat.inguinal hernia – simple	K40.2
J3033, Bilat.recur.inguinal hernia – simple	K40.2
J30y2, Bilat.inguinal hernia unspecified	K40.2
J30y3, Bilat.recur.inguinal hernia unspecified	K40.2
J301, Inguinal hernia + obstruction	K40.3
J3010, Unilat.inguinal hernia + obstruction	K40.3
J3011, Unilat.recur.inguinal hernia + obstruction	K40.3
J301z, Inguinal hernia + obstruction NOS	K40.3
J302, Inguinal hernia – irreducible	K40.3
J3020, Unilat.inguinal hernia – irreducible	K40.3
J3021, Unilat.recur.inguinal hernia – irreducible	K40.3
J302z, Inguinal hernia – irreducible NOS	K40.3
J300, Inguinal hernia with gangrene	K40.4
J3000, Unilat.inguinal hernia + gangrene	K40.4
J3001, Unilat.recur.inguinal hernia + gangrene	K40.4
J300z, Inguinal hernia + gangrene NOS	K40.4
J303, Simple inguinal hernia	K40.9
J3030, Unilat.inguinal hernia – simple	K40.9
J3031, Unilat.recur.inguinal.hernia – simple	K40.9
J303z, Simple inguinal hernia NOS	K40.9
J304, Direct inguinal hernia	K40.9
J305, Indirect inguinal hernia	K40.9
J30y, Inguinal hernia unspecified	K40.9
J30y0, Unilat.inguinal hernia unspecified	K40.9
J30y1, Unilat.recur.inguinal hernia unspecified	K40.9
J30yz, Inguinal hernia unspecified NOS	K40.9
J30z, Inguinal hernia NOS	K40.9
J3112, Bilat.femoral hernia + obstruction	K41.0
J3113, Bilat.recur.femoral hernia + obstruction	K41.0
J3122, Bilat.femoral hernia – irreducible	K41.0
J3123, Bilat.recur.femoral hernia – irreducible	K41.0
J3102, Bilat.femoral hernia + gangrene	K41.1
J3103, Bilat.recur.femoral hernia + gangrene	K41.1
J3132, Bilat.femoral hernia – simple	K41.2
J3133, Bilat.recur.femoral hernia – simple	K41.2
J31y2, Bilat.femoral hernia – unspecified	K41.2
J31y3, Bilat.recur.femoral hernia – unspecified	K41.2

READ^{TM} *diagnostic codes and their ICD10 equivalents* (Continued)

Read diagnostic code	ICD 10
J311, Femoral hernia + obstruction	K41.3
J3110, Unilat.femoral hernia + obstruction	K41.3
J3111, Unilat.recur.femoral hernia + obstruction	K41.3
J311z, Femoral hernia + obstruction NOS	K41.3
J312, Femoral hernia – irreducible	K41.3
J3120, Unilat.femoral hernia – irreducible	K41.3
J3121, Unilat.recur.femoral hernia – irreducible	K41.3
J312z, Femoral hernia – irreducible NOS	K41.3
J310, Femoral hernia with gangrene	K41.4
J3100, Unilat.femoral hernia + gangrene	K41.4
J3101, Unilat.recur.femoral hernia + gangrene	K41.4
J310z, Femoral hernia + gangrene NOS	K41.4
J313, Simple femoral hernia	K41.9
J3130, Unilat.femoral hernia – simple	K41.9
J3131, Unilat.recur.femoral hernia – simple	K41.9
J313z, Simple femoral hernia NOS	K41.9
J31y, Unspecified femoral hernia	K41.9
J31y0, Unilat.femoral hernia unspecified	K41.9
J31y1, Unilat.recur.femoral hernia unspecified	K41.9
J31yz, Unspecified femoral hernia NOS	K41.9
J31z, Femoral hernia NOS	K41.9

Procedure codes

*Office of Population and Census Surveys, fourth revision (OPCS4) and READ codes for hernia procedures**

OPCS4	READ	Description
T19	7H10	Simple excision of inguinal hernia sac
T20	7H11	Primary repair of inguinal hernia
T21	7H12	Repair of recurrent inguinal hernia
T22	7H13	Primary repair of femoral hernia
T23	7H14	Repair of recurrent femoral hernia

Four-digit codes are available to give a greater degree of precision.

In the text of this document, primary inguinal hernia repair refers to codes T19 and T20 combined.

* Supplementary codes may be required for bowel resection, for example, or for relief of bowel strangulation.

Case-mix groups

Diagnosis-related groups (DRGs)

DRG code	Description
161	Inguinal and femoral hernia procedures in a patient aged > 17 years without complications or co-morbidity
162	Inguinal and femoral hernia procedures in a patient aged > 17 years with complications or co-morbidity
163	Hernia procedures in a patient aged 0–17 years

*Health-related groups (HRGs)**

HRG	OPCS4
F73	T19
F74	T20 to T23

* Where there are complications or co-morbidities, HRGs will be lifted to a resource group higher than the two listed. For instance, where the procedure involves a bowel resection, the HRG will be that for bowel resection.

Appendix II: Grading of evidence

Size of effect

A. The procedure/service has a strong beneficial effect.
B. The procedure/service has a moderate beneficial effect.
C. The procedure/service has a measurable beneficial effect.
D. The procedure/service has no measurable beneficial effect.
E. The harms of the procedure/service outweigh its benefits.

Quality of evidence

I-1 Evidence from several consistent, or one large, randomised controlled trial.
I-2 Evidence obtained from at least one properly designed randomised controlled trial.
II-1 Evidence obtained from well-designed controlled trials without randomisation, or from well-designed cohort or case–control analytic studies.
II-2 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence.
III Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.
IV Evidence inadequate and conflicting

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