

Chronic pain after surgery

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Chronic pain after surgery has until recently been a neglected topic. The extent of the problem first came to light in a survey of patients attending pain clinics in Scotland and the north of England.¹⁷ This survey showed that about 20% of patients attending chronic pain clinics implicated surgery as one of the causes of their chronic pain and, in about half of these, it was the sole cause. An extensive literature search failed to produce any references on the general topic of chronic pain after surgery. There were, however, almost 400 references on chronic pain after specific operations, such as mastectomy, cholecystectomy and thoracotomy. The information from this literature search formed the basis of a chapter, entitled 'Chronic postsurgical pain',³³ in *Epidemiology of Pain*, edited by I. K. Crombie and published by the IASP Press in 1999.¹⁴ Much of the information in this review is published in greater detail in that chapter and I am grateful to IASP Press for permission to use some of the material included in it.

One of the problems facing anyone reviewing this topic is the quality of the publications. Many of the studies identified by the literature search were of poor quality. For example, in some of the papers the methods section explained how to do the surgical operation but, in some cases, did not clearly identify the number of patients investigated, the definitions used, the follow-up time or the outcome measures. Many of the problems that will be addressed below (see Defining chronic post-surgical pain) were simply ignored in most studies. One of the interesting findings from the literature is that studies which are designed specifically to investigate the incidence of chronic pain after any operation always find a higher incidence than studies in which chronic pain is studied only as part of a much broader investigation. It also has to be said that these broader studies tend to be less well conducted, often with serious methodological flaws.

The content of this review will be as follows. An attempt will be made to define chronic post-surgical pain and to discuss some of the difficulties in reaching a workable definition. The pain syndromes associated with many

individual types of operation will be discussed briefly, with reference to some of the publications in each category. Where appropriate, information will be displayed in table form. The management of patients with chronic post-surgical pain will be mentioned, but not reviewed in detail. Lastly, the reasons for the neglect of the subject of chronic post-surgical pain will be explored and some suggestions made about how this could be rectified.

Defining chronic post-surgical pain

Defining when a pain becomes chronic is always difficult. Pain that is unlikely to resolve or pain that lasts longer than the usual healing time have been suggested, as well as various time scales, usually 6 or 3 months.³⁷ In pain after surgery, there is an added problem because many patients undergo surgery because of a painful condition, such as gallstones or a prolapsed intervertebral disc, and the pre-existing pain will confuse the issue. Is the pain merely a continuation of the pre-surgical problem or is it a new problem? If it is new, is it related to the surgery? In some cases it is obvious that there is a new problem, for example if there is nerve injury after cholecystectomy the pain will be quite different from the pain of gallstones and will be accompanied by sensory changes. In many cases, though, it is difficult to disentangle the pains, especially if the pain that the patient complained of before surgery is not helped by the operation.

In order for pain to be classified as chronic post-surgical pain, the following criteria should be satisfied.³³

- The pain developed after a surgical procedure.
- The pain is of at least 2 months duration.
- Other causes for the pain should have been excluded (e.g. continuing malignancy or chronic infection).
- The possibility that the pain is continuing from a pre-existing problem must be explored and exclusion attempted. (There is an obvious grey area here in that surgery may simply exacerbate a pre-existent condition, but attributing escalating pain to the surgery is clearly not

Table 1 Chronic pain after breast surgery. VRS=verbal rating scale; VAS=visual analogue scale; MPQ=McGill pain questionnaire

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
Survey	Various	Patient support group volunteers	314 in sample, 251 responses of which 223 usable	Descriptions and VRS	16 months to 32 yr (mean 8 yr)	Phantom breast 36% Numbness 39–78% Paraesthesiae 19–35% Sensitivity 23–34% Pain 22–32%	46
Prospective cohort	Phantom breast pain, scar pain	Oncology and radiotherapy department	120 patients, 110 at 1 yr	Descriptive	1 yr	Phantom breast pain 3 weeks 13% 1 year 13% Scar pain 3 weeks 35% 1 year 23%	30
Prospective cohort	Phantom breast pain, scar pain	Oncology and radiotherapy department	120 patients, 110 at 1 yr, 69 at 6 yr	Descriptive	6 yr	Phantom breast pain at 6 yr 17% Scar pain at 6 yr 31%	29
Retrospective cohort	Pain, strange sensations and paraesthesiae	Breast cancer patients from department of surgery	569 contacted, 467 analysed	VAS, VRS, MPQ and drug use	9–58 months	Pain 49% Paraesthesia 54% 'Strange sensations' 50%	65
Retrospective cohort	Pain	Breast cancer patients from medical centre	479 contacted, 282 responses	VAS, MPQ	2–6 yr	Pain 1 yr after mastectomy 31% Mastectomy/reconstruction 49% Breast augmentation 38% Breast reduction 22%	68
Survey	Pain	Oncology out-patients (grab sample)	95 patients	MPQ and cancer pain questionnaire	Not stated	Post mastectomy pain 20%	61
Survey	Morbidity after axillary dissection	Patients attending breast clinic	126 patients	Not stated	6 months to 4 yr	1 year 45% 1–2 yr 37% 2–4 yr 28% >4 yr 20%	23

possible as natural deterioration cannot be ruled out.) Unfortunately, in most of the published studies no attempt at definition is made. In studies in which a definition is used, it varies from study to study.

Chronic post-surgical pain syndromes

Pain after breast surgery

There are several publications on chronic pain after breast surgery and they vary widely in the design and quality of the studies. The majority of the studies are concerned with pain after surgery for breast cancer, usually mastectomy with or without axillary clearance. Table 1 summarizes the data from some of these studies and shows that morbidity after breast surgery is common and that it persists with time. Several types of pain syndrome are described: phantom breast pain, pain in or around the scar, pain in the chest wall and pain in the arm. Phantom sensations after mastectomy have been studied extensively by Kroner and colleagues.^{29 30} The phantoms may be painless but, in many cases, the patient suffers phantom pain after mastectomy, with an

incidence varying from about 13% at 3 weeks to 17% at 6 yr. However, these data have to be interpreted with caution as these patients all had breast cancer and there was an inevitable fall in number from 120 to 69 over the 6-yr period. Scar pain in this group of patients remained constant at about 30% over the 6-yr period. It is important to realise that surgery is not the only cause of pain in this group of patients, and Vecht and colleagues⁶⁷ found nine different categories of problems in 38 patients who they studied with pain in the arm after mastectomy. In only eight of this group was the pain definitely attributable to nerve injury caused by the surgery. Other causes included brachial plexus neuropathy resulting from infiltration by cancer or radiotherapy, cervical radiculopathy, carpal tunnel syndrome and pericapsulitis of the shoulder joint. Another important finding from this study is related to the timing of the onset of the pain. Post-surgical pain normally developed within the first few weeks after the operation. In contrast, pain from infiltration caused by cancer or radiotherapy normally developed after a median delay of around 5 yr. This pattern of onset was repeated for thoracic surgery and will be discussed further below (see Pain after thoracic surgery).

The nature of the breast surgery influences the incidence of problems. Wallace and colleagues⁶⁸ investigated pain after mastectomy, mastectomy with reconstruction, cosmetic augmentation and breast reduction. Almost half of those who had mastectomy with reconstruction had pain at 1 yr compared with only about one-third of those who had mastectomy alone and a quarter of those who had breast reduction. In this study, patients who had implants had a higher incidence of pain (53%) than those who did not (30%). Pain is not the only symptom experienced by these patients, and Polinsky⁴⁶ showed that many patients are greatly troubled by numbness, paraesthesia and sensitivity, as well as pain. She also reported considerable morbidity related to chemotherapy and radiotherapy. Tasmuth and colleagues confirmed these findings in a study of 569 women who had undergone modified radical mastectomy with axillary clearance or breast resection with axillary clearance.⁶⁵ They reported that about one-third to one-half of the patients suffered from pain, paraesthesia, oedema, strange sensations or muscle weakness. One-quarter of the patients reported a significant effect on their daily lives from these symptoms. This study also showed that those patients who had radiotherapy and chemotherapy as well as surgery had the highest incidence of pain. In a study of 126 women after axillary clearance, who had neither radiotherapy nor chemotherapy, Ivens and colleagues²³ showed that 70% of women complained of numbness, 33% of pain, 25% of weakness, 24% of arm swelling and 15% of stiffness. In 39% of these patients the symptoms affected their daily lives. In a study of 95 women after breast surgery, Stevens and colleagues reported significant interference with the performance of daily occupational and domestic activities.⁶¹ They found that the women were undertreated and had poor pain relief and symptom control.

Not only has the problem of chronic pain after surgery been neglected but Watson and colleagues⁶⁹ reported that misdiagnosis is common. In only two of the 18 patients that they studied with post-mastectomy pain syndrome was the correct diagnosis made before referral. Many of the patients were labelled as having 'emotionally derived pain' by the referring physician. The authors used the Beck Depression Inventory to evaluate depression and found that only six of the 18 patients scored in the mildly depressed range. Given that all these patients had breast cancer and chronic pain, it is surprising that the level of depression was not higher. What is depressing is that several years later, articles are still appearing which implicate psychological causes for pain after breast surgery.⁵⁴

Pain after thoracic surgery

When you consider what is involved in a thoracotomy, it is not surprising that many patients suffer long-term pain afterwards. In order to gain access to the chest, the surgeon has to either resect a part of a rib or spread ribs, which inevitably causes mechanical trauma both anteriorly and

posteriorly. The intercostal nerves lie along the lower border of the ribs and are liable to injury, which may be quite subtle and need not involve transection. Experience from other pain syndromes suggests that many of the worst pain syndromes are caused by partial nerve injury. Therefore, it is not surprising to find that patients suffer a wide range of symptoms after thoracotomy. The best-recognized pain syndrome after thoracotomy is probably related to injury to the intercostal nerves. This produces a typical neurogenic type of pain syndrome, with both spontaneous and evoked pain, as well as other sensory disturbances. The incidence of pain after thoracotomy has been the subject of several studies and these are summarized in Table 2.

Although pain after thoracotomy is fairly common, the severity varies, and typically 80% of patients scoring 4 or less on a 10-point visual analogue scale.¹⁶ In a large and well-conducted study, Richardson and colleagues found a point prevalence of post-thoracotomy neuralgia of 22% at 2 months and 14% at 12 months. In 15% of these patients, the pain was sufficiently troublesome to require a pain clinic referral.⁵¹

Again, the timing of the onset of pain can have important implications for causality. Pain related to the operation usually starts in the immediate post-operative period or the first few weeks thereafter. Two studies looking at patients with thoracic cancer have shown that, if the pain starts after a pain-free period or gets worse after an interval of relatively mild pain, the cause is likely to be tumour recurrence.^{28 35} The study by Keller and colleagues²⁸ also suggests that those who have more severe pain before the operation may be more likely to develop chronic pain after the procedure.

Several studies have investigated the influence of post-operative pain control on the development of chronic pain after thoracotomy. In a retrospective study of 90 patients Matsunaga and colleagues³⁵ found that the proportion of patients who reported chronic pain varied according to their need for analgesia in the acute post-operative period. Of the 32 patients who required analgesia every day during the first 14 days after surgery, 91% had pain at 6 months. In the 45 patients who did not need analgesics every day, only 44% had pain at 6 months. Kalso and colleagues²⁶ in a retrospective study of 150 patients followed up for 2 yr found that patients with ongoing chronic pain were significantly more likely to report their acute post-operative pain as excruciating and the pain relief provided as being poor. In a prospective study, Katz and colleagues²⁷ found that early post-operative pain was the only factor that significantly predicted long-term pain. The link between post-operative pain and chronic pain does not necessarily imply causality but is nonetheless interesting and deserves further investigation.

Several studies have investigated different types of thoracotomy. However, inevitably, most of these studies have been quite small and the results must be interpreted with caution. From existing studies, it is not possible to

Table 2 Chronic pain after thoracotomy. VAS=visual analogue scale; VRS=verbal rating scale; MPQ=McGill pain questionnaire

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
Survey of records	Post-thoracotomy neuralgia	Hospital records: 10-yr period	3109 records	Not stated	≥3 months	5%	11
Retrospective cohort	Post-thoracotomy neuralgia	1000 consecutive patients after thoracotomy	1000 records, 883 analysed	Not stated	≥2 months	Pain at 2 months 22%, pain at 12 months 14%. Severe enough for referral in 15% of patients	51
Retrospective cohort	Post-thoracotomy pain	Hospital records: patients after thoracotomy and video-assisted thoracic surgery	391 contacted, 343 responses	VAS and VRS	>3 months	Pain after lateral thoracotomy <1 yr 44% 1 yr 29% After video-assisted surgery <1 yr 30% >1 yr 22%	31
Retrospective cohort	Post-thoracotomy pain	Hospital records	56 patients	VAS	≥2 months	54% with pain	16
Retrospective cohort	Chest pain	Hospital records: 50 consecutive patients	50 patients	VAS, MPQ and analgesic requirement	Up to 6 months	Pain at 6 months Non-serratus sparing antero- axillary thoracotomy 8% Posterolateral thoracotomy 12%	42
Prospective, randomized, blind trial of cryoanalgesia	Post-thoracotomy pain	60 consecutive patients	53 patients	VAS and analgesic use	6 weeks and 6 months	Pain in cryoanalgesia group 23%, pain in control group 7%	53
Retrospective cohort	Post-thoracotomy pain	Additional phone follow-up of post-thoracotomy patients in trial	30 patients initially, but only 23 contacted	VAS and MPQ	Approximately 1.5 yr after thoracotomy	52% post-thoracotomy pain	27
Retrospective cohort	Post-thoracotomy pain	Medical records of patients who had thoracotomies	214 records, 150 survivors, 134 replies	Analgesic use	≥6 months	44% post-thoracotomy pain	26
Retrospective cohort	Post-thoracotomy pain	238 consecutive patients	238 patients	Pain assessment card; pain impact statement	≥3 months	11% post-thoracotomy pain	28
Retrospective cohort	Post-thoracotomy pain	Surgical records	90 contacted, 77 responses	Not stated	6–18 months	67% post-thoracotomy pain, 20% required medication	35

reach any firm conclusions about whether technique influences long-term pain. It would be expected that thoracoscopic procedures would produce less long-term chronic pain than open procedures. Once again, no clear evidence has emerged on this topic but it is already clear that thoracoscopic procedures still carry a significant long-term morbidity.

Chronic pain after cholecystectomy

Cholecystectomy is a difficult area to investigate because most patients have bouts of pain before surgery and in many patients problems persist after cholecystectomy. Typically, around 40% of patients still complain of problems, many of which relate to pain.^{4 52} On the other hand, patients are led

to believe by their doctors that their symptoms will be relieved by the operation.⁵²

A summary of studies on chronic pain after cholecystectomy is shown in Table 3. Although these studies show a prevalence of chronic pain varying from 3% to more than 20%, they fail to take account of pre-existing problems and, in most cases, the type of pain. Furthermore, the pain measures used are vague or are not described.

It might be expected that laparoscopic cholecystectomy would produce a lower incidence of problems. Although two studies have compared laparoscopic with open cholecystectomy, the results are contradictory and neither of the studies was prospective, randomized nor properly blinded.^{62 71} There have been many publications purporting to investigate the safety, efficacy and complications of laparoscopic cholecystectomy, often with quite large

Table 3 Chronic pain after cholecystectomy

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
Retrospective cohort	Upper abdominal pain	Hospital patients after open and laparoscopic cholecystectomy	450 contacted, 360 responses	Not stated	Mean follow up: laparoscopic 15 months, open 32 months	Pain after laparoscopic 3.4%, pain after open procedure 10%	62
Survey	Stomach pain	Hospital patients after open and laparoscopic cholecystectomy	315 contacted, 267 responses	Not stated	At least 12 months, mean 14 months	Pain after laparoscopic 7%, pain after open procedure 7%	71
Retrospective cohort	Symptoms after cholecystectomy	Hospital patients after open cholecystectomy	1930 patients	Dyspepsia or abdominal pain similar to pre-operative symptoms	2 – 9 yr	Prevalence of all symptoms 40%, dyspepsia 11%, mild pain 24%, severe pain 6%	6
Prospective cohort	Pain and other symptoms after cholecystectomy	Elective patients scheduled for cholecystectomy	130	Not stated	2 yr	Dull upper abdominal pain 21%	52
Retrospective cohort	Symptoms after cholecystectomy	Hospital patients after open cholecystectomy	1716 patients initially, 862 contacted, 800 analysed	Not stated	4 yr	Prevalence of all symptoms 31%, 4% with severe pain	59
Prospective cohort	Pain after cholecystectomy	Consecutive patients after cholecystectomy	115 patients	Not stated	12 months	Persistent abdominal pain 27%	4

numbers of patients, but most rarely mention long-term complications.

Chronic pain after dental surgery

Two distinct chronic pain syndromes have been reported after dental surgery—post-traumatic dysaesthesia and phantom tooth pain. The incidence of phantom tooth pain after endodontic therapy has been reported as 3%.³⁴ For other pain syndromes, the incidence has been reported as varying from 5% to 13% (Table 4).^{8, 32} An interesting finding from the study by Lobb and colleagues³² was that most patients who suffered chronic pain after dental surgery did not revisit the dental surgeon. This does suggest that many dental surgeons will be underestimating the morbidity of the procedures.

Pain syndromes after amputation

Pain after limb amputation is undoubtedly the best-documented of all the post-surgical pain syndromes. After limb amputation, pain syndromes fall into two broad categories—stump pain (sometimes called residual limb pain) and phantom pain. Phantom pain is the subject of a separate paper in this issue.⁴¹ Pain after amputation is such an important topic that it will be briefly reviewed here as well. The prevalence of stump pain varies widely according to different studies. Pohjolainen found a prevalence of only 5% in a study of amputees attending a prosthetics factory.⁴⁵

In a study of US Army veterans, Sherman and colleagues⁵⁵ found an incidence of 62%. Patients often report a tender spot on the stump, and this has led many surgeons to perform exploratory operations searching for neuromas or other triggering factors. Patients in the past have frequently had further amputations in the mistaken belief that this would cure the problem. Local operations rarely help stump pain in the long term and sometimes make patients worse or make it more difficult for them to wear a prosthesis.

The reported incidence of phantom limb pain varies from 85% to around 50%.^{24, 45, 55} Carlen and colleagues⁹ investigated phantom limb pain in amputees after the Yom Kippur war and found an incidence of 67%. They studied the onset of the phantom pain and found that it was immediate in 12% of patients, came on during the first day in 10%, during the first week in 12%, the second week in 5%, third week in 16% and later than the third weeks in 2%. The remainder of the patients either had no pain or were uncertain about the date of onset. Phantom pain episodes were studied by Sherman and colleagues,⁵⁵ who showed that over a quarter of patients suffered phantom pain for more than 15 h a day and one-fifth of patients had pain for 1 h or less. Over a quarter of patients suffered phantom pain on more than 20 days in each month, another quarter suffering phantom pain on between 6 and 20 days per month, half the patients had pain on 5 days per month or less. Information on the severity of phantom pain is contradictory. Some studies describe only mild or moderate pain but others have shown up to 40% of amputees having

Table 4 Chronic pain after dental surgery

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
Survey	Phantom tooth pain	Endodontic therapy patients	732 contacted, 463 usable replies	Not stated	Not stated	3%	34
Survey	Pain	Surgical endodontic patients	206 contacted, 118 responses	Not stated	Not stated	5%	8
Prospective cohort	Pain after endodontic treatment	Surgical endodontic patients	198 contacted, 165 responses	Not stated	1 yr	13%	32

severe phantom pain.^{45 56} Several studies have looked at the natural history of phantom limb pain and show that, in a patient population, the prevalence of phantom limb pain does not change. However, some patients improve while others become worse. The duration and frequency of phantom limb episodes tend to decrease in the first 6 months but remain stable thereafter.²⁴

Many studies have tried to investigate risk factors for developing phantom limb pain, but this topic remains controversial. There is no association with age, sex, site of amputation, reason for amputation, ethnicity or educational level. Two studies have shown no correlation with the use of a prosthesis^{24 55} but one study showed that the length of time between the amputation and receiving a prosthesis significantly correlated with phantom limb pain.⁶⁰ This study also showed that 91% of those who did not have phantom limb pain used their prosthesis all day whereas only 27% of those who had phantom limb pain used their prosthesis all day. It is impossible to say from this study whether the use of the prosthesis was preventing the phantom limb pain or whether the phantom limb pain was preventing the use of the prosthesis. Three risk factors have been identified—stump pain,^{24 38 55} pre-amputation pain^{22 24 40} and non-painful phantom sensations.³⁸

Phantom pain in children has been a particularly controversial area, some authors claiming that young children do not suffer phantom limb pain and that those with congenital absence of limbs never suffer phantom limb pain. Both these assertions seem to be false. In a study looking at amputation in children,⁵⁷ the prevalence of phantom pain after trauma was 12% but in those with cancer it was 48%. Interestingly, in this subgroup, the incidence rose to 74% if the children had chemotherapy before or at the time of amputation, was 44% if the chemotherapy was after the amputation but was only 12% if chemotherapy was not given.

In the past few years, there has been an explosion of interest in changes in the nervous system after amputation. Using sophisticated scanning techniques, it has been demonstrated that the sensory cortex remaps after amputation. Loss of a limb or part of a limb also causes other problems for the central nervous system, which may involve, for example, the visual pathways and the motor

control system. It is thought that these changes may contribute to the development of phantom limb pain. There have been some extraordinary reports of temporary resolution of phantom limb pain using virtual limb boxes containing mirrors, where the patient's brain is fooled into thinking that they still have the missing part.⁴⁸ Recent research has shown incontrovertibly that there is a central component to pain after amputation even if there may also be peripheral drive. This exciting new work underlines the futility of methods of treatment aimed at the stump or even the peripheral nervous system to try to relieve phantom pain.

Phantom pain has been described after removal of other body parts, such as the rectum,^{5 43} breast,²⁹ tongue,¹⁹ teeth³⁴ and genitals.²¹ It is interesting that despite the fact that circumcision is the commonest operation carried out on males, there are no reports of phantom foreskin in the literature.

Other chronic post-surgical pain syndromes (Table 5)

Chronic pain after hernia repair is well known to all doctors who work in pain clinics. There are many studies on outcome after hernia repair, but most are of poor quality. Many of the studies do not mention pain and few have looked at this syndrome in detail. In a well-designed prospective randomized trial comparing three methods of open repair, Cunningham and colleagues¹⁵ found an incidence of pain at 12 months of 63%, with 12% suffering moderate or severe pain. At 2 yr, 54% of patients had pain, which was moderate or severe in 11%. A prospective study of laparoscopic herniorrhaphy¹² found a 15% incidence of pain with a follow-up period that averaged 9 months. Inguinal hernia repair using mesh has been reported to cause chronic neuralgia, although the incidence is not reported.²⁰ Numbness can also be a common problem after hernia repairs and has been reported in a quarter of patients at 2 yr.¹⁵

Chronic pain after orthopaedic surgery has been the subject of very few studies. In particular, long-term follow-up of chronic pain after trauma is neglected. There have been some studies looking at chronic pain after elective

Table 5 Chronic pain after surgery (miscellaneous). VAS=visual analogue scale; LA=local anaesthetic

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
<i>Hernia</i>							
Prospective randomized trial of three surgical techniques	Pain	Trial patients receiving hernia repair	315 patients	VAS	6, 12 and 24 months	Pain at 12 months 63% with 12% moderate or severe. Pain at 2 yr 54%, with 11% moderate or severe	15
Prospective study of trans-peritoneal laparoscopic herniorraphy	Pain	Trial patients receiving hernia repair	60 patients	Not stated	Average follow up 9 months	15%	12
<i>Sympathectomy</i>							
Unclear	Neuralgia after phenol sympathectomy	Patient records	1028 patients but 1666 sympathectomies	Not stated	Not stated	Pain after 9% of operations in 15% of patients	50
Survey	Post- sympathectomy neuralgia after open sympathectomy	Patient records	100 patients but 142 operations	Not stated	Not stated	13%	47
Prospective cohort	Post- sympathectomy neuralgia after open sympathectomy	Patients having open sympathectomy	56 patients but 96 operations	Not stated	6 months	35%	49
Prospective cohort	Neuralgia after sympathectomy with phenol or alcohol	Patients having sympathectomy	386 patients	Pain description 'mild to severe'	6 months	Pain after alcohol sympathectomy 40%, pain after phenol 20%	13
<i>Orthopaedic surgery</i>							
Prospective cohort	Prepatellar neuropathy	Patients after open meniscectomy	87 patients	Dysaesthesia in area of operation	6 months	44% at 6 months	63
Prospective trial	Thigh pain after hip replacement	Two types of hip replacement	215 patients	Thigh pain	1 and 2 yr	Pain at 1 yr 13 and 7%, pain at 2 yr 23 and 3%	7
Retrospective cohort	Pain after total hip replacement	Patients after total hip replacement	505 patients	Not stated	Mean 102 months, range 42–171	Pain when sitting 16%, pain when walking 35%	25
<i>Cardiac surgery</i>							
Retrospective cohort	Chest wall pain	Patients after coronary artery bypass grafting	178 patients	Pain affecting daily life or return to work	Minimum 1 yr, maximum 22 months	5–70% depending on site of harvested bypass conduit	18
<i>Rectal amputation</i>							
Survey	Perineal pain	Patients after abdominoperineal resection for rectal cancer	286 contacted, 177 replies	Presence of perineal pain	≥5 yr	12%	5
Retrospective cohort	Phantom pain	Patients after rectal amputation	22 (21 with cancer)	Phantom sensations and pain	Mean 44 months, range 14–90	68% with phantom sensation, 18% with pain	43

orthopaedic surgery. Swanson reported a 44% incidence of dysaesthetic pains around the knee after open meniscectomy.⁶³ Outcome after joint replacement has been studied widely but chronic pain has rarely been included. In a

prospective study looking at two types of hip prosthesis, Burkart and colleagues⁷ found incidences of 13 and 7% at 1 yr and 23 and 3% at 2 yr. A retrospective study of over 500 patients after total hip replacement²⁵ reported an incidence

Table 5 Continued

Study type	Outcomes studied	Source of study subjects	Sample size	Pain measure	Duration of follow-up	Estimated prevalence of symptoms	Reference
Vasectomy Retrospective cohort	Testicular pain	Hospital records	172 men	Not stated	4 yr	33% chronic discomfort, 15% 'troublesome', 5% sought further medical help	36
Retrospective cohort	Testicular pain	Hospital records	396 men	Not stated	Mean 19 months, range 8–39	5% chronic testicular pain and 10% pain on intercourse	1
Randomized control trial	Testicular discomfort	Men undergoing vasectomy and enrolled in trial	70 men	VAS	1 yr	37%, control group had pain for 2–24 weeks No pain reported in active group (LA)	44

of pain on sitting of 16% and pain on walking of 35%. The patients were followed up for a mean (range) of 102 (42–171) months.

Turner and colleagues⁶⁶ reviewed patient outcomes after lumbar spinal fusion operations. Of the 47 articles found, none was a randomized trial. This makes interpretation almost impossible as most of the operations were performed because of pre-existing back or leg pain. Only six of the studies gave details of continuing back pain and only two of chronic leg pain. Surgery for back pain is a controversial area and it is remarkable that the quality of studies is so poor.

There is a fairly extensive literature on pain after lumbar sympathectomy. Post-sympathectomy neuralgia is a syndrome of pain in the thigh, often of a burning nature, which can occur after sympathectomy and typically lasts 2–3 months. The incidence has been variously quoted as 12–35% after both open sympathectomy^{47–49} and percutaneous phenol sympathectomy.^{13–50} The fact that the incidence is so similar after open and percutaneous sympathectomy suggests that the problem is a result of the sympathectomy itself rather than the technique used to achieve it. In the past, some authors have blamed the spread of phenol from the sympathetic chain posteriorly to the spinal nerve roots for this pain syndrome. There has never been any evidence to support this claim, and the fact that open sympathectomy has the same incidence of post-sympathectomy neuralgia suggests that spread of phenol is not the cause. Fortunately, this syndrome is normally self-limiting, which is in contrast to many of the other pain syndromes following surgical procedures.

Vasectomy is the second most common operation performed on men worldwide. It is performed for social reasons rather than because of illness and men having vasectomies are pain-free before the procedure. It is distressing, therefore, to find that chronic testicular pain occurs in between 5%¹ and 33%³⁶ of patients. Once again, several different syndromes have been described and the

pain may be spontaneous or may occur during intercourse. In an interesting study on the influence of local anaesthesia, Paxton and colleagues⁴⁴ injected local anaesthetic on one side but not on the other. They concluded that injecting the local anaesthetic prevented the development of chronic pain after vasectomy. Unfortunately, this finding is not borne out by experience as patients do present to pain clinics with pain after vasectomy performed under local anaesthetic. It is possible that, in these cases, local anaesthesia was incomplete.

Chronic pain after cardiac surgery is another problematical area because many patients present with angina. Differentiating angina from the pain after surgery can be difficult for patients. However, some patients do have a typical dysaesthetic, neurogenic type of pain syndrome and, if veins are harvested from the leg, damage can be caused to the saphenous vein with consequent neurogenic pain in the leg. Eng and Wells¹⁸ reported that the use of the internal mammary artery carried a higher incidence of chronic pain compared with the use of veins.

Pain after prostatectomy, although usually of low intensity, has a reported prevalence of 33% 20 weeks after surgery.³⁹ Pain after colposuspension was investigated by Wheelan,⁷⁰ who found that 27% of patients had pain, which persisted for 2 months or longer but disappeared by 4 months.

The initial pain clinic survey showing an unexpectedly high incidence of pain after surgery¹⁷ reported several patients having pain after hysterectomy. Therefore, it is disappointing that there are no high-quality studies investigating chronic pain after gynaecological surgery.

Clinical presentation and management of chronic post-surgical pain syndromes

Most pain clinicians are moving away from classical diagnostic categories to a more mechanism-based diagnosis

in patients with chronic pain. This approach aims to understand the mechanism causing the patient's pain and to direct treatment at that mechanism. For example, if the cause of the pain is a nerve injury, the treatment should be directed at whatever mechanism is thought to be responsible for that neurogenic pain. Sadly, although this approach is probably a step forward, it is still very crude. It does have utility, however, especially in the treatment of this group of patients. Treatment does not depend upon what sort of surgery the patient has had but rather on the mechanism which results in the patient having pain. To this end, the patient's description of the pain is of great importance and the use of such words as tingling, burning and shooting will alert the clinician to the possibility of neurogenic pain, whereas aching or sharp pains with local tenderness may be related to a nociceptive or inflammatory cause. Sensory testing is important, and findings of anaesthesia, allodynia (pain from a stimulus that is not normally painful, such as cotton wool) or hyperalgesia (more pain than one would expect from a painful stimulus, such as a pinprick) should confirm the diagnosis of a neurogenic type of pain. The patient should also be questioned carefully about pre-existing pains. Frequently, patients will tell you that they have had a pain since the operation, but on further questioning, and perhaps on looking at the patient's notes before surgery, one finds that the patient's pain has not changed significantly from before the operation.

The most important aspect of management is to listen to the patient's story, perform a thorough examination and then give a full and frank explanation of the problem. Patients often report finding this approach helpful in itself. Often they feel that, in the past, their symptoms have been dismissed and not taken seriously. Sometimes, patients have been told that the pain will go away soon after the operation (which is at variance with the published data) and this causes mistrust and resentment.

The best treatment for the patient's pain will depend upon the mechanism that is causing it. Neurogenic pain is best treated by tricyclic antidepressants such as amitriptyline, anticonvulsants such as gabapentin or sodium valproate, or a combination of the two. Nociceptive pains can be managed with simple analgesics such as paracetamol or stronger drugs such as weak opioids tramadol or, occasionally, stronger opioids. There is no reliable published evidence on any of these treatments specifically for chronic post-surgical pain but, in essence, the treatment of this type of syndrome is no different from that of other chronic pain syndromes. Transcutaneous electrical nerve stimulation is widely used and can undoubtedly be effective in some cases. It has the advantage of having few side-effects and will not cause any long-term damage. The same cannot be said for ablative techniques. Peripheral nerve ablation has no place in the management of these syndromes and carries an unacceptable morbidity. Local injections of anaesthetic and steroid may be useful but repeated injections of steroids are not without risk.

It is not always possible to control the pain and other symptoms adequately. In such cases, patients will require a psychology-based pain management approach to help them to cope with their problems and reduce the impact on their daily lives. Many patients, for example those with cancer, or patients who have had a mastectomy or a limb amputation, may have special needs.

Reasons for neglect

It is clear from the studies described that chronic post-surgical pain is common, can be severe and results in distress and disability for patients. Why then has this been neglected? In a survey of surgical textbooks, the author found that the general topic of chronic pain after surgery was totally ignored. In many textbooks, chronic pain after operations such as mastectomy, thoracotomy and hernia repair were either mentioned very briefly or ignored altogether. It is hard for any doctor to accept that the treatments they offer may cause morbidity, especially if they feel that they may be to blame. In the past, doctors have often sought to blame patients for diseases that they feel helpless to treat.^{3 58}

When one looks at the whole spectrum of the syndromes of chronic pain after surgery, it seems unlikely that the cause of the pain is related to something that the surgeon has done wrong. It seems more likely that this is the inevitable result of surgery in a certain percentage of patients. The author and some other pain specialists feel that certain groups of patients may be more at risk from pain after surgery than others. The patients at higher risk include patients who suffer from such conditions as Raynaud's disease, especially bipolar Raynaud's with erythromelalgia, irritable bowel syndrome, migrainous headaches, fibromyalgia and perhaps several other conditions as well. Changes in the nervous system may well lie behind many of these syndromes. Neural plasticity can result in amplification of sensory input,¹⁰ which may result in somatic or visceral hyperalgesia. This could well have a bearing on chronic post-surgical pain. There is also evidence from animal work that some strains of rat and mice are more likely to develop neurogenic pain after nerve injury than others. It may be that certain people are at particularly high risk of developing pain after surgery. There is evidence that postoperative pain is influenced by psychological and familial factors.^{2 64}

Perhaps if it was more widely accepted that chronic pain can arise after surgery, three benefits might result. The first might be that if patients were given accurate data about the incidence of pain after certain operations, some of these patients might decide against having operations that weren't entirely necessary. The second benefit would be that patients would have their pain acknowledged and they would be treated more sympathetically and would not feel blamed in the way that many do at present. It might also benefit surgeons who are undoubtedly trying to do the best for their patients. Patients do not blame their doctor if they

develop a side-effect like a rash after taking a drug, as it is accepted that side-effects can occur. If pain after surgery was acknowledged in the same way, it might be easier for everyone.

Conclusions

Chronic pain after surgery has been a neglected topic until recently. A wide variety of operations have been shown to be associated with chronic pain syndromes and it is probable that, for the others, the problem also exists but has merely not been documented. Patients complain of a diverse group of symptoms and management must involve careful attention to each of the problems that the patient suffers. For the longer term, a shift in attitude is required and there is an urgent need for good quality research to try to elucidate risk factors and causes.

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