

Retrospective Study

The Benefit of Therapeutic Medial Branch Blocks after Cervical Operations

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Disclaimer: There was no external
funding in the preparation of this
manuscript.

Conflict of interest: None.

Manuscript received: 08/04/2010

Revised manuscript received:
09/20/2010

Accepted for publication:
10/25/2010

Free full manuscript:
www.painphysicianjournal.com

Background: Persistent neck pain is a common problem after surgery of the cervical spine. No therapy recommendation exists for these patients.

Objectives: The objective of this study was to determine if a therapeutic medial branch block is a rational treatment for patients with postoperative neck pain after cervical spine operations.

Study Design: Retrospective practice audit.

Setting: Review of charts of all patients who underwent cervical spine operations for degenerative reasons during a time period of 3 years.

Methods: Patients with persistent postsurgical pain were treated with therapeutic medial branch blocks (local anesthetic and steroid). A positive treatment response was defined if at least 80% reduction of pain could be achieved or if the patient was sufficiently satisfied with the relief. All patients with a minimum follow up time of 6 month were included.

Results: Of the 312 operations performed, 128 were artificial disc operations, 125 were stand alone cages, and 59 were fusions with cage and plate. Persistent neck pain occurred in 33.3 % of the patients. There was no difference between the patients with neck pain and the whole group of patients. More than half of the patients with neck pain—52.9%—were treated successfully with therapeutic medial branch blocks. Since no further treatment was necessary, the initial treatment was considered successful. Nearly a third—32.2%—of the patients were initially treated successfully, but their pain recurred and further diagnostics and treatments were necessary. In this group of patients, significantly more with double level operations were found ($P = 0.003$). Patients not responding to the medial branch block were 14.9%.

Limitations: This audit is retrospective and observational, and therefore does not represent a high level of evidence. However, to our knowledge, since this information has not been previously reported and no recommendation for the treatment of post-operative zygapophysial joint pain exists, it appears to be the best available research upon which to recommend treatment and to plan higher quality studies.

Conclusions: For persistent postsurgical neck pain only limited therapy recommendations exist. This study suggests treating these patients in a first instance with therapeutic medial branch blocks. The success rate is 52.9 %.

Key words: Chronic neck pain, cervical zygapophysial pain, cervical facet joint pain, medial branch blocks, therapeutical cervical facet joint nerve blocks, postsurgery syndrome, pain therapy

Pain Physician 2010; 13:527-534

The primary aim of a ventral operation on the cervical spine is the decompression of the spinal cord and the spinal nerves. Sometimes the patient is dissatisfied with the result of the operation because of persistent neck pain even though a good decompression and an improvement of the radicular pain was achieved. This situation can incur increased cost and burden to patients and the health care system (1). Patients with persistent pain following spine surgery are often seen in interventional pain management settings (1). Approximately 15% to 40% of patients present with disabling neck pain after spine surgery (1).

One of the reasons to implant a graft (for example a cage or an artificial disc) after removal of the disc is to avoid postoperative zygapophysial joint pain. With an implant it is possible to achieve a better or normal lordosis and a correct alignment and more stability. Instability or an incorrect alignment means more load to the zygapophysial joints and therefore the possibility of pain. The large number of different implants we can choose from indicates that we still do not have an ideal substitute for the disc. Discussion continues about different types of implants and the advantages and disadvantages of rigid fusions compared to motion prevention with an artificial disc. The different implants vary not in terms of better decompression of the nerve structures but in terms of zygapophysial joint load.

It is important to define the sources of postsurgical pain so as to find a specific treatment option. Possible pain sources are perineural and epidural scarring with nerve root adhesions, muscle spasms, ligaments, and the zygapophysial joints. While there is extensive literature to demonstrate that the prevalence of cervical zygapophysial joint involvement in chronic neck pain is between 36% and 67% (1-15) only one study shows the prevalence of zygapophysial joint pain after cervical spine operations. Manchikanti et al (1) found a positive response to controlled medial branch blocks in 36% of patients after cervical spine operations compared to 39% in nonsurgical patients. So it seems obvious that the zygapophysial joints are also an important source of pain after operations of the cervical spine.

Cervical zygapophysial joint pain can radiate to the head, neck and shoulders. The joints are well innervated by the medial branches of the dorsal rami (16). Free nerve endings can be found in the joints. Therefore the zygapophysial joints are a possible pain source.

The literature provides limited information regarding the treatment of zygapophysial joint pain, with only

medial branch blocks and radiofrequency neurotomy showing evidence of effectively reducing pain (15-18).

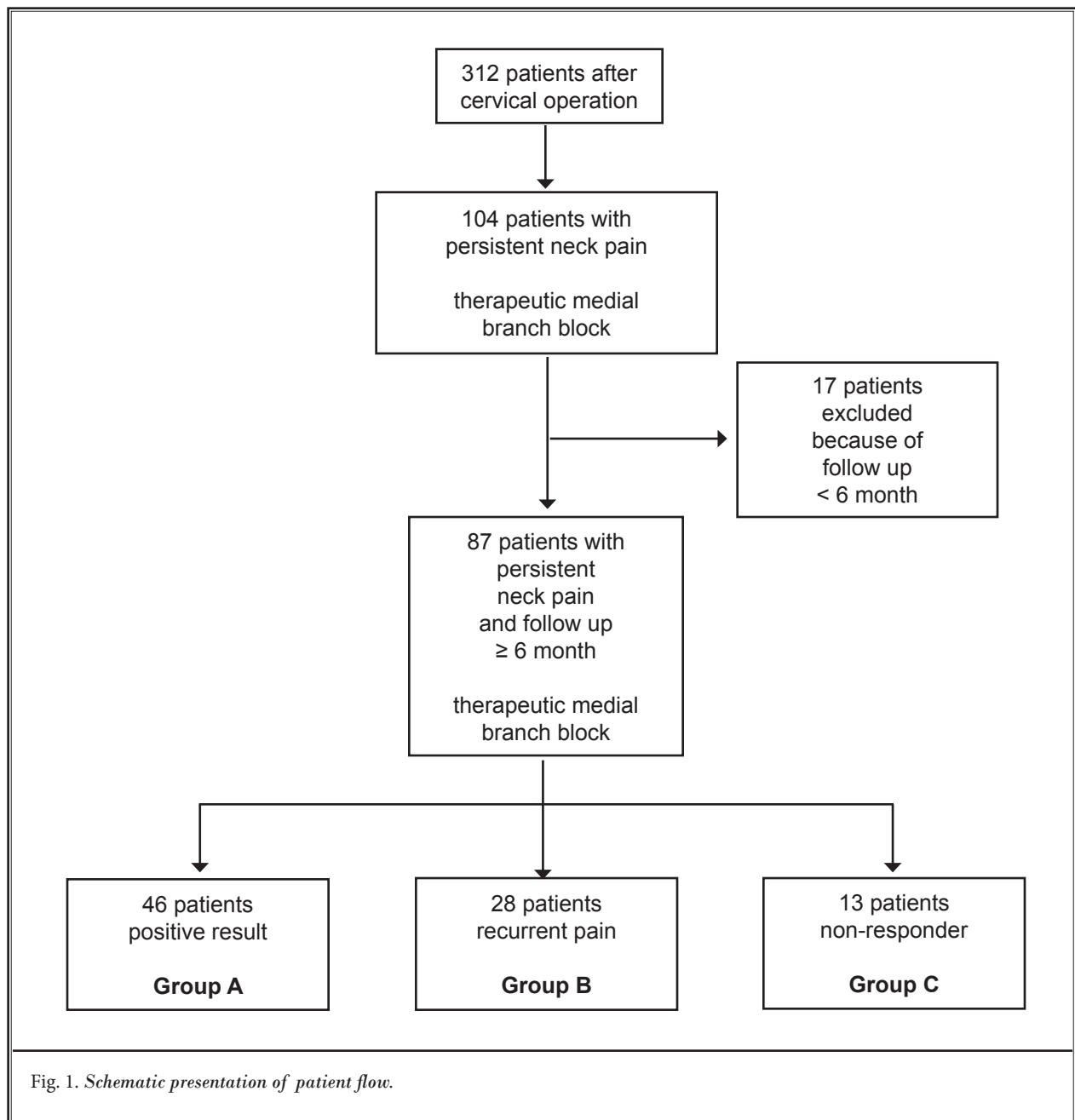
The rationale of radiofrequency neurotomy is to interrupt nociceptive pathways. Cervical medial branch blocks are a diagnostic procedure designed to test if a patient's pain is mediated by one or more of the medial branches of the cervical dorsal rami. But for example the systematic review by Falco et al (15) reports strong evidence of relief of neck pain when treated with therapeutic medial branch blocks. Also other studies present encouraging results for using therapeutic blocks (18,19). Among patients after cervical surgery most likely inflammatory processes play a role in their pain because of an initial stress to the joints. Therefore this therapy was adapted to patients with postsurgical neck pain.

The aim of this study was to find out if a therapeutic medial branch block is a rational treatment for postsurgical neck pain. The results are analyzed for different types of ventral cervical operations and different implants used. It was explored if a prediction was possible regarding which patients would respond particularly well or badly with a medial branch block.

METHODS

An electronic medical record system was used to identify all patients in a single spine center who had received a ventral cervical operation for a degenerative reason, either a herniated disc or a stenosis of the spinal canal during a time period of 3 years (between January 2006 and December 2008). All patients were included with operations in one level or in 2 adjacent levels. Different types of implants were used: Two types of artificial discs (Prodisc C, Synthes and Prestige, Medtronic), a stand alone cage (titanium or Peek, Pina) or a combination cage with plate (Zephir, Medtronic). All operations were performed by the same surgeon. The operations were during a hospital stay. The follow-up was done in a practice setting. The pain therapy procedures were performed in an interventional pain management ambulatory surgery center. Patients with a follow-up time of less than 6 months were excluded from the evaluation (Fig. 1).

Neck pain of the cervical spine is very common during the first weeks after surgery. All patients were treated with nonsteroidal anti-inflammatory medication for the first days and started with physiotherapy about 2 weeks after the operation. The first follow-up examination was between 2 and 3 weeks after the operation. Further examinations were arranged according



to the complaints of the patients. During the convalescence period the complaints subsided. Patients asking for a therapy because of persisting or worsening neck pain and a history suggestive of zygapophysial joint pain were treated with a therapeutic cervical medial branch block with a combination of triamcinolone (5 mg) and bupivacaine (0.25%) (15,18-21) (Fig. 2). About

1 mL of fluid was injected for each joint. The idea of using a steroid in combination with an anesthetic was to treat a postsurgical inflammatory process. Injections were performed with fluoroscopic visualization using established techniques (2). The response was evaluated. Some patients did not respond to the block and were assigned to group C (non-responder). Patients with

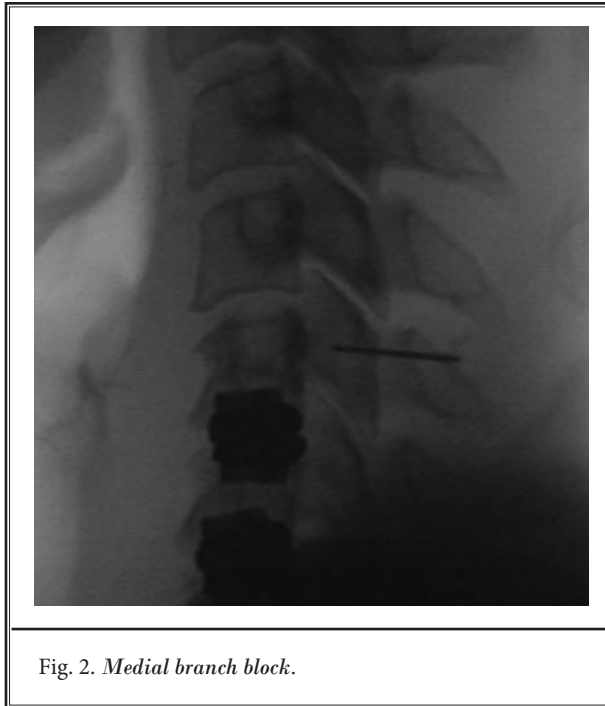


Fig. 2. *Medial branch block.*

satisfying pain relief (at least 80%) were divided into 2 groups (Fig. 1). In the first group were patients who remained pain free (Group A, positive result). Patients with an initially satisfying pain relief but recurrent pain were assigned to Group B (recurrent pain). In these patients further diagnostic and treatment techniques were applied. For example, a diagnostic cervical medial branch block with a local anesthetic (bupivacaine 0.25%) was done prior to performing radiofrequency neurotomy in cases of a positive response (22).

When performing medial branch blocks, different zygapophysial joints were eligible. The medial branch blocks were performed on the side experiencing pain. Patients with bilateral pain received bilateral medial branch blocks. Sometimes the operated level was included, often the adjacent level cephalad or caudad to the operation. At a minimum, 2 levels were tested at the same time. Target joints were identified by the pain pattern, local tenderness over the area, and provocation of pain with deep pressure. Very helpful for identifying the level was the pain map of the cervical zygapophysial joints (21-24).

A positive treatment response was defined if at least 80% reduction of pain could be achieved or if the patient was sufficiently satisfied with the relief. The statistical analysis was done with Chi-square tests.

RESULTS

Between January 2006 and December 2008, 312 ventral cervical operations for degenerative reasons were performed. Artificial discs were implanted in 128 patients; of them, 113 were Prodisc C and 15 were Prestige. In 125 cases where stand-alone cages were used, 46 were titanium and 79 were Peek. A combination cage and plate was provided to 59 patients. The age of the patients was between 24 and 78 years, the mean age being 49.0 years. Patients treated included 147 males and 165 females. Single level operations were performed in 225 patients. The most frequent levels were C5/6 (122 cases) and C6/7 (82 cases). Eighty-seven patients had surgery at 2 adjacent levels (C4/5/6 in 14 cases, C5/6/7 in 73 cases). Nine patients had a second operation because of adverse effects. The data are shown in Table 1. The distribution of the age, gender and the level of operation do not show any peculiarities. Nearly the same number of patients was provided with an artificial disc (41.0%) compared with stand-alone cages (40.1%). The mean follow-up time was 10.3 months (between one and 49 months, standard deviation 11.0).

One hundred-four patients (33.3%) presented with persistent neck pain after surgery and showed symptoms suggesting zygapophysial joint pain. These patients were treated by a therapeutic medial branch block with triamcinolone and bupivacaine. Seventeen of these patients were not included in further evaluations because of a follow up time less than 6 months. Table 1 shows that there was no significant difference between the 87 patients with persistent neck pain and the whole group of patients after surgery in age, gender, levels being operated, and in the types of operation (artificial disc versus stand alone cage or combination cage and plate). The follow up time in this group with symptomatic patients was longer (mean 20.40 month, between 6 and 49 month, standard deviation 10.5).

Of the patients presenting with persistent neck pain, 52.9% (46/87) were treated successfully with the therapeutic medial branch block (Group A). The success was enduring; no further treatment was necessary. This means that the success rate of therapeutic medial branch blocks for patients with persisting neck pain after ventral operations of the cervical spine is 52.9%. Unfortunately, the follow up varied widely, but 36 patients (78.3%) in Group A were followed up for excess of 12 months. If patients with less than 6 months follow-up are also taken into account, the success is even greater (56.7%, 59/104 patients). The reason might be that sat-

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Table 1. Analysis of the results in groups A, B and C dependent on patient characteristics and operation type.

	All Patients		Neck Pain		A Positive Result		B Recurrent Pain		C Non-responder	
	n	%	n	%	n	%	n	%	n	%
Number	312		87		46		28		13	
Follow-up										
month	1-49		6-49		6-49		6-48		6-39	
Ø	10.34		20.40		20.50		21.00		18.77	
men	147	47.12	41	47.13	21	45.65	11	39.29	9	69.23
women	165	52.88	46	52.87	25	54.35	17	60.71	4	30.77
Age										
years	24-78		28-76		31-76		33-65		28-70	
Ø	49.01		48.57		48.67		48.71		47.92	
20-29	4	1.28	1	1.15	0	0.00	0	0.00	1	7.69
30-39	36	11.54	10	11.49	6	13.04	2	7.14	2	15.38
40-49	143	45.83	40	45.98	20	43.48	16	57.14	4	30.77
50-59	91	29.17	29	33.33	18	39.13	7	25.00	4	30.77
60-69	28	8.97	5	5.75	1	2.17	3	10.71	1	7.69
70-79	10	3.21	2	2.30	1	2.17	0	0.00	1	7.69
Level										
single	225	72.12	56	64.37	33	71.74	13	46.43	10	76.92
double	87	27.88	31	35.63	13	28.26	15	53.57	3	23.08
C3/4	2	0.64	0	0.00	0	0.00	0	0.00	0	0.00
C4/5	16	5.13	5	5.75	2	4.35	2	7.14	1	7.69
C5/6	122	39.10	35	40.23	22	47.83	8	28.57	5	38.46
C6/7	82	26.28	16	18.39	9	19.57	3	10.71	4	30.77
C7/1	3	0.96	0	0.00	0	0.00	0	0.00	0	0.00
C4/5/6	14	4.49	3	3.45	2	4.35	1	3.57	0	0.00
C5/6/7	73	23.40	28	32.18	11	23.91	14	50.00	3	23.08
Operation type										
Prodisc C	113	36.22	30	34.48	15	32.61	11	39.29	4	30.77
Prestige	15	4.81	5	5.75	2	4.35	2	7.14	1	7.69
Titan	46	14.74	14	16.09	9	19.57	4	14.29	1	7.69
PEEK	79	25.32	25	28.74	14	30.43	7	25.00	4	30.77
plate	59	18.91	13	14.94	6	13.04	4	14.29	3	23.08
Onset										
early			37	42.53	19	41.30	15	53.57	4	30.77
late			50	57.47	27	58.70	13	46.43	9	69.23

ified patients did not come to further examinations.

Nearly a third (28/87) of the patients, 32.2%, with persisting neck pain were initially treated successfully with therapeutic medial branch block but the pain recurred (Group B). These patients needed further diagnostics and treatment. There was a statistically significant

difference in the distribution of single-level and double-level operations between Group B patients and the whole group of patients. In the whole group, there were 72.1% who had a single level operation and 27.9% who had a double level operation, compared with 46.4% single level and 53.6% double level opera-

tions in Group B ($P = 0.003$ exact Fisher test). The responsible level is C5/6/7 (Table 1). The patients of Group B had the longest follow up time (mean 21.0 months, between 6 and 48 month, standard deviation 11.4).

The remaining patients (14.9%, 13/87) did not respond to the therapeutic medial branch block (Group C). It seems obvious that the pain in these patients was not caused by the zygapophysial joints. The ratio of men to women was 69.2% to 30.8% compared to 47.1% to 52.9% in the whole group of patients being operated.

Discussion

Various reasons for postoperative neck pain generated by the zygapophysial joints are conceivable. First of all, degenerative alterations of the spine are not reversible and often cannot be changed by an operation, especially if the changes are located adjacent to the operated levels. If these alterations are pain generators, they will also be responsible for pain after the operation. In addition, there are possible effects of a ventral cervical spine operation, which differ depending on the type of operation. After performing a fusion with cage or cage and plate, the so-called "adjacent level syndrome" may occur. The range of motion is decreased across the fusion level relative to the intact spine and is compensated for by an increase in motion at the adjacent segments (25). The incidence of disc degeneration is increased at levels adjacent to fusion sites in the cervical spine (26-28). Changes can occur in the load on zygapophysial joints after interbody fusion (26). During extension movements of the neck, the zygapophysial joint force increases significantly in the adjacent segments and decreases in the treated level. Significant load on the zygapophysial joints may stretch the joint capsules (29,30) and therefore might be a source of pain. The situation after arthroplasty with a disc prosthesis is different. Arthroplasty is performed to maintain the range of motion and decrease the rate of adjacent segment disease. But the range of motion in the surgically treated segment even increases and therefore the zygapophysial force increases at the treated level. One reason may be that the axis of rotation is located in the posterior portion of the designed implant (31). As a result, the loading on the posterior elements is increased. Another reason is that often ball-socket joints are used with an unlimited range of rotation. In summary, after an arthrodesis the zygapophysial joints of the adjacent segment are more probably the pain generators, and after arthroplasty, the joints of the treated level. A few more reasons are imaginable. After fusion with a stand-

alone cage, there might be instability or a remaining range of motion in a non physiological way inducing pain. Independent of which graft is used, it is important to obtain a correct alignment with a physiological distribution of the load. For the same reason the location of an artificial disc and the center of rotation must be correct. At the least, the height of the implant should correlate with the load of the zygapophysial joints. To find the correct height of an implant during the operation it is very helpful to see the joint space in fluoroscopy. These different reasons demonstrate how much the flexion of the spine is changed by implanting a graft into the intervertebral space.

In the present study, 27.9% of patients developed neck pain after ventral cervical surgery. Most of these were treated satisfactorily with therapeutic medial branch blocks. It is controversial whether this is a useful therapy. Therefore this study provides interesting results. Originally, a medial block was intended for diagnostic purposes (2). This treatment was adopted because several studies presented encouraging results (18,19). A systematic review reported strong evidence (Level II-1) of at least short-term relief of neck pain when treated with medial branch blocks (15). The recommendation given (1B or 1C) is strong for providing short-term and long-term relief in the treatment of chronic cervical zygapophysial joint neck pain.

Facetogenic pain is the result of repetitive stress, leading to inflammation and stretching of the joint capsule (32). Therefore, among patients with temporary pain, most likely inflammatory processes play a role because of an initial stress to the joints during the operation (capsular tension because of spreading the disc space) and stress during the time the cervical spine becomes accustomed to the new static situation. The inflammation can be treated with steroids and the spine becomes accustomed to the new static situation.

The results of Group A (52.9% satisfied patients) validate that a therapeutic medial branch block is a rational therapy for neck pain in postsurgical patients. There are no therapy recommendations for the treatment of neck pain after cervical surgery in the literature except experiences with radiofrequency neurotomy (22). In consequence of this study it seems appropriate to first treat patients with a therapeutic medial branch block. A radiofrequency neurotomy can be a useful tool for recurrent pain. From the data shown in Table 1 it is not possible to predict which patients achieve the best results. Differences between the levels being operated on and between fusion and arthroplasty were not significant.

But there is one result which emphasizes the importance of the extent of the surgical intervention and the difference between postsurgical and nonpostsurgical patients. In the group of patients with recurrent pain (Group B) this was statistically significant; they had a higher prevalence of double-level operations. This suggests that the extent of previous surgery, and the number of levels treated, is a major risk factor for postsurgical neck pain not being temporary.

As well, post-surgical patients might have sources of pain other than just the zygapophysial joints. Patients not responding to the medial branch block were 14.9%. It remains unclear why there are more men than women in Group C.

In summary, persistent postsurgical neck pain is a common problem for which there are limited therapy recommendations. For a specific therapy, this study suggests treating these patients initially with a therapeutic medial branch block.

There are limitations of this study. It was a retrospective practice audit. The outcome was qualitative rather than quantitative. The main problem is the widespread follow-up time. Unfortunately, some patients did not attend their subsequent follow-ups. We do not

know if they did not come again because they were satisfied with the result, or if their relief lapsed. Nevertheless, the follow-up was sufficient to show that at least 36 of 46 patients in Group a (78.3%) maintained relief in excess of 12 months.

This audit is retrospective and observational, and therefore does not represent a high level of evidence. However, to our knowledge, since this information has not been previously reported and no recommendation for the treatment of post-operative zygapophysial joint pain exists, it appears to be the best available research upon which to recommend treatment and to plan higher quality studies. Further studies are needed to investigate the possibility of applying therapeutical medial branch blocks to complex situations like persistent post-operative pain. A remaining unanswered question is whether or not medial branch blocks are also a reasonable therapy for nonsurgical patients with neck pain.

CONCLUSION

For persistent postsurgical neck pain only limited therapy recommendations exist. This study suggests treating these patients in a first instance with therapeutic medial branch blocks. The success rate is 52.9 %.

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