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Systematic Review

A Systematic Review of Neuraxial Anesthesia in Patients with Ankylosing Spondylitis

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Abstract

Objectives: Ankylosing spondylitis is a rare disease that presents difficulties for general and regional anesthesia techniques in patients undergoing surgery. Thoracic kyphosis, flattening of the lumbar spine, and in patients with advanced stage AS, formation of syndesmophytes can complicate neuraxial anesthesia. This review examines spinal, epidural, and caudal anesthesia practices for patients with ankylosing spondylitis.
Methods: According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement, an electronic literature search was performed by three authors on 01.01.2017 without history limitation. English articles that reviewed neuraxial anesthesia applications for cases with ankylosing spondylitis were included.
Results: In total, 17 articles with 20 patients were included. Most cases were males (16; 80%). Spinal anesthesia was performed for 40% of patients (thoracic epirak anesthesia, 25%; lumbar epidural anesthesia, 15%; caudal anesthesia, 10%; combined spinal–epidural anesthesia, 10%). A median approach was selected for eight patients (40%), whereas a paramedian approach was selected for seven patients (35%). Of the 20 approaches, three failed (15%). While the most application region was the thoracic region (45%; nine cases), generally (90%) no imaging technique was used.
Conclusion: We believe that in patients with syndesmophyte formation in the thoracic or lumbar regions, the paramedian approach should be considered as a useful alternative to the median approach, or an imaging technique may also be used.
Keywords: Ankylosing spondylitis, caudal anesthesia, epidural anesthesia, neuraxial anesthesia, spinal anesthesia

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Spondyloarthropathies are clinical syndromes that include genetic predispositions.[1] Ankylosing spondylitis (AS) is a rheumatic spondyloarthropathy disease that is three times more likely to occur in men than in women, with a peak incidence that occurs between 20 and 45 years of age and a prevalence estimated to be 0.5%.[2, 3] AS is associated with the class I human leukocyte antigen allele B27 and is histologically characterized by the formation of a new bone at the joint.[4]

AS is important in the practice of anesthesia because spinal inflammation leads to ankylosis, limiting chest expansion and neck movement and leading to a flattening of the thoracic kyphosis and lumbar spine.[2] As a result, AS can complicate intubation and spinal and epidural anesthesia practices.[5] Deformities of joints are generally observed in individuals whose disease has been present for >10 years.[6] AS also affects the cardiovascular system (aoritis, aortic insufficiency, and conduction abnormalities), respiratory system (upper lobe fibrosis and pleural thickening), urinary system (secondary amyloidosis and IgA nephropathy), and nervous system (cauda equina syndrome).[7]

This diversity of conditions imply that patients with AS re-

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Table 1. Cases of neuraxial anesthesia for ankylosing spondylitis

Reference, no	Age/years Sex	Operation	Anesthesia technique/ interlaminar space	Approach	Imaging technique	Success
Varadajan et al.[8]	57/M	CABG	TEA-GA/T1-2	Median	No	Yes
Varadajan et al.[8]	51/F	CABG	TEA-GA/T1-2	Median	No	Yes
Chin et al.[22]	40/F	THR	SA/L4-5	Median	USG	Yes
Sivrikaya et al.[11]	30/F	C/S	SA/L3-4	Median	No	Yes
Hyderally et al.[10]	55/M	THR	CSEA/L3-4	?	No	Yes
Batra et al.[9]	58/M	THR	EA/L3-4	Paramedian	No	No/TSA
Sng et al.[12]	33/F	C/S	CSEA/?	Paramedian	No	Yes
Allen et al.[19]	74/M	AAA	TEA-GA/T10-11	?	No	No/EH
Canakcı et al.[23]	45/M	Inguinal hernia	SA/L3-4	Median	No	Yes
Rodi et al.[13]	42/M	L2 vertebrae fracture	EA/T11-L2	Paramedian	No	Yes
Kumar et al.[24]	28/M	Knee surgery	SA/L3-4	Paramedian	No	Yes
Kumar et al.[24]	52/M	THR	SA/L3-4	Paramedian	No	Yes
Kumar et al.[24]	42/M	Knee surgery	SA/L3-4	Paramedian	No	Yes
Leung et al.[14]	65/M	Femur fracture	SA/L3-4	Median	Minilaminotomy	Yes
Weber et al.[15]	29/M	Anal fistula	CA/sacral hiatus	–	No	No
Deboard et al.[17]	50/M	THR	CA/sacral hiatus	–	No	Yes
Gustafson et al.[20]	46/M	Acute pancreatitis	EA/T11-12	Median	No	Yes
Robins et al.[21]	63/M	Duodenal surgery	EA-GA/T7-8	Median	No	Yes
Oyoma et al.[18]	73/M	THR	EA/L3-4	Paramedian	No	Yes
Jindal et al.[25]	52/M	Percutaneous nephrolithotomy	SA/L5-S1	Taylor approach	No	Yes

CABG: coronary artery bypass grafting; THR: total hip replacement; AAA: abdominal aortic aneurysm; C/S: cesarean section; SA: spinal anesthesia; EA: epidural anesthesia; CA: caudal anesthesia; CSEA: combined spinal and epidural anethesia; TEA-GA: thoracic epidural anesthesia and general anesthesia.

quire various operations, including coronary artery bypass grafting, total hip replacement, cesarean sections, surgery for fractures of vertebrae or femur, anal fistula excision, and thyroidectomy.[8-15] Therefore, patients with AS are likely to require anesthesia at some point in their lives. Because of expected difficulties in intubation and associated organ system involvement, performing general anesthesia in patients with AS is often a cause for concern. In such cases, regional anesthesia [peripheral nerve blocks and neuraxial anesthesia (NAA)] may be considered as an alternative.

This review aimed to investigate regional anesthesia practices and approaches selected as alternatives to general anesthesia in patients with AS, who form a rare group of the surgical patient population.

Materials and Methods

An electronic search of the literature published up to January 01, 2017 was performed by the three authors to examine the use of NAA in patients with AS. Combinations of keywords (ankylosing spondylitis, regional anesthesia, spinal anesthesia, epidural anesthesia, caudal anesthesia, and neuraxial anesthesia) were used as search terms in the PubMed electronic database. No date (year of publication) limitation was applied, but only English articles were included. Articles reporting data (age, sex, number of patients, type of operation, anesthesia procedure, application range and method, use of imaging techniques, and indication of success) for qualitative synthesis were included in this review.

The methodology of this review was according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[16]

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS, edition version 16.0, Chicago, IL, USA) software. Data were expressed as mean± standard deviation, and a one-sample t-test was applied to one group averages.

Results

Seventy-six unique articles were identified by screening databases; 58 were excluded for the following reasons: review article (n=1), concerned peripheral nerve blockade (n=1), not published in English (n=7), involved only local anesthesia (n=2), involved only general anesthesia (n=13), and not related to the issue being studied (n=33). The remaining 18 articles were examined for the eligibility criteria, and one additional article was excluded. As a result, 17 articles with 20 cases were included (Table 1); data are displayed using a

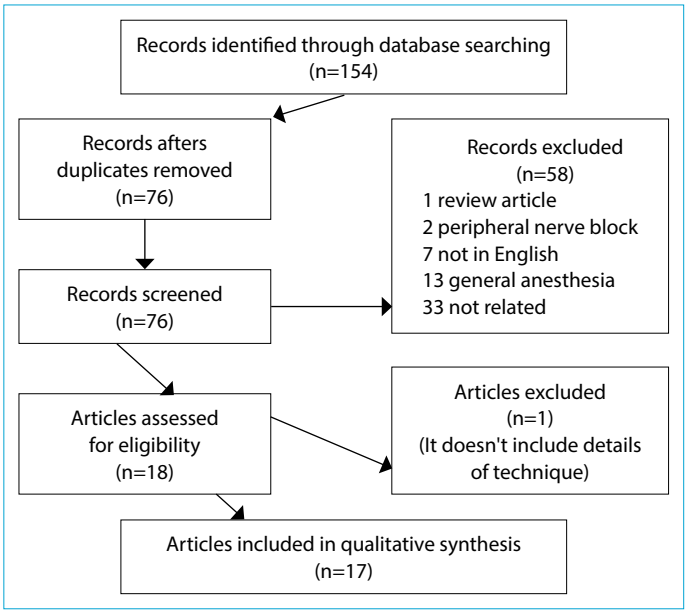

Figure 1. PRISMA flow diagram.

flow diagram (Fig. 1).[8-15,17-25]

Statistical analysis is summarized in Table 2. Most cases were males (16; 80%); the mean age of males was 51.9±13.4 years and that of females was 38.5±9.32 years. The operations conducted included orthopedics (50%), general surgery (20%), cardiovascular surgery (15%), cesarean section (10%), and urological surgery (5%). Ultrasound imaging and NAA with minilaminotomy under local anesthesia were performed in one case each (5%).

Spinal anesthesia was the most commonly used technique (40%).[11, 14, 22-25] Other techniques included thoracic epidural anesthesia (25%),[8, 19-21] lumbar epidural anesthesia (15%),[9, 13, 18] caudal anesthesia (10%),[15, 17] and combined spinal–epidural anesthesia (10%).[10, 12]

NAA was mostly applied in the thoracic region (45%; nine cases), followed by L3-4 interlaminar space (30%; six cases). A median approach was selected for eight patients (40%), whereas a paramedian approach was selected for seven patients (35%). Of the 20 approaches, three failed (15%). Total spinal anesthesia and epidural hematoma each occurred once.

Table 2. Analysis of cases

	n=20	%
Sex		
Male	16	80
Female	4	20
Operation		
Orthopedics surgery	10	50
General surgery	4	20
Cardiovascular surgery	3	15
Cesarean/section	2	10
Urological surgery	1	5
Anesthesia technique		
Spinal anesthesia	8	40
Thoracic epidural anesthesia	5	25
Lumbar epidural anesthesia	3	15
Caudal anesthesia	2	10
Combined spinal-epidural anesthesia	2	10
Approach		
Median	8	40
Paramedian	7	35
Other	3	15
Unknown	2	10
Interlaminar space		
Thoracic	9	45
L3-4	6	30
Other	3	15
L4-5	1	5
Unknown	1	5
Imaging technique		
No	18	90
Ultrasound	1	5
Minilaminotomy	1	5
Success		
Yes	17	85
No	3	15
Age (years)		
Male	51.94±13.36	
Female	38.50±9.32	

Discussion

Syndesmophytes, defined as longitudinal ligament ossifications, have been identified by radiological examination after sacroiliitis in patients with AS, making it impossible to these layers. However, using spinal or epidural anesthesia is difficult for cases with thoracic kyphosis, flattening of lumbar spine, and loss of flexibility in vertebral joints.[2, 4]

Pathological findings such as vertebral syndesmophytes and loss of flexibility occur after approximately 10 years with the condition. Therefore, as the duration of the disease increases, the difficulty of NAA application increases. Patients included in this review had AS follow-up between 9 and 27 years.[9, 11]

Of the NAA techniques used for patients included in the articles examined, eight[8, 11, 14, 20-23] had median approaches, whereas seven[9, 12, 13, 18, 24] had paramedian approaches. Paramedian approaches were preferred in one of the three cases that failed.[9] In the other two cases, caudal anesthesia [15] and thoracic epidural anesthesia were used.[19] Schelew et al.[26] published their NAA experiences with 19 cases having difficult surface anatomic landmarks (16 spinal anes-

and three epidural anesthesia); the success rate of spinal anesthesia was 76.2%, and all three cases of epidural anesthesia application were unsuccessful.

However, in cases where spinal and epidural anesthesia were performed, the success rate of spinal and epidural anesthesia was 100% and 70%, respectively.

Analysis of complications associated with NAA in patients with AS revealed epidural hematoma in a thoracic epidural patient and total spinal anesthesia in a lumbar epidural patient.[9,19] Only one other patient under salisilicasit medication was reported to have epidural hematoma, but the cause could not be clearly identified.[10] Wulf et al.[27] demonstrated that in 51 patients with spinal–epidural hematoma, five had AS, suggesting multiple attempts could be the reason for hematoma in those patients. Based on these observations, multiple NAA applications could contribute to epidural hematoma formation.

Because of the difficulty associated with the median approach in patients with AS, the paramedian approach is often selected. Imaging was performed applied in only one case. In all other cases (excluding one patient with a femur fracture under local anesthesia), spinal anesthesia was applied after mimilaminotomy.[14,22] Preoperative imaging with ultrasound may be useful in the application of spinal anesthesia and selection of anesthesia methods.[28,29] Therefore, the use of imaging techniques is likely to be helpful for patients with AS when NAA application is expected to be difficult. The use of ultrasound in NAA has been recently suggested.[28] The advantages of easy positioning and absence of radiation exposure make USG preferable to fluoroscopy. However, USG was performed in only one patient in the literature we assessed, suggesting that there remains a great opportunity for preoperative assessment and application of USG in NAA for patients with AS.[22]

Our review was limited by the English-language restriction, and because the application of NAA is rare in patients with AS, our analysis was limited to case reports only.

Conclusion

There is a longstanding history of complications associated with NAA for patients with AS having syndesmophyte formation, with only limited data available from personal experience and case reports.

In conclusion, owing to complications such as total spinal anesthesia and epidural anesthesia, as well as the need for multiple attempts for a successful block, spinal anesthesia may be preferable to other NAA techniques. In patients with syndesmophyte formation in the thoracic or lumbar regions, the paramedian approach should be considered a useful alternative to the median approach. In patients with advanced stage AS, imaging techniques such as fluoroscopy and USG can assist in selecting NAA approaches.

Disclosures

Peer-review: Externally peer-reviewed.

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