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Intractable pain due to thoracic outlet syndrome successfully treated with percutaneous epidural adhesiolysis: A case report

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Abstract

Thoracic outlet syndrome (TOS) is characterized by intractable cervicobrachial pain caused by strangulation of the brachial plexus and subclavian artery by structures of the superior thoracic outlet. We describe percutaneous epidural adhesiolysis for refractory pain due to TOS. A man in his 40s had received nerve block therapy for right upper extremity pain of unknown origin for 5 years. Although imaging findings were negative for TOS, reproducible pain relieved by injection of a local anesthetic into the anterior scalene muscle suggested TOS due to compression by the muscle. Subsequently, since nerve block treatment had only temporary effect and the pain gradually worsened, right T1 epidural adhesiolysis was performed. Thereafter, the pain improved from a numerical rating scale score of 8-9/10 to 2-3/10, continuing for about 3 months. Epidural adhesiolysis was remarkably effective in treating intractable pain caused by TOS due to strangulation of the brachial plexus by the anterior scalene muscle.

Keywords

Thoracic outlet syndrome (TOS), intractable pain, percutaneous epidural adhesiolysis (PEA), pulsed radiofrequency, Racz catheter

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Introduction

Thoracic outlet syndrome (TOS) is a syndrome that was proposed by Peet et al. in 1956 and is characterized by compression and traction of the brachial plexus, subclavian artery, and subclavian vein by structures such as the cervical rib, clavicle, first rib, and muscles including the anterior scalene, middle scalene, and pectoralis minor. Depending on the site of the compression, it is also referred to as scalene syndrome, costoclavicular syndrome, or hyperabduction syndrome.[1] TOS can be divided into neurological, arterial, and venous types based on the structure that is compressed, manifesting with variable symptoms, such as arm and hand pain, numbness, paralysis, and muscle weakness in the arm, or as arm edema due to circulatory disorders.[2,3] Treatment options include exercise therapy, pharmacotherapy, nerve blocks, and surgery, which are selected based on the severity of symptoms and patient preference.[4] However, TOS often becomes refractory, leading to debates regarding the appropriate treatment strategies. Here, we present a case in which percutaneous epidural adhesiolysis (PEA) led to improvement of refractory pain due to TOS. Written, informed consent was obtained from the patient for publication of this case report.

Case presentation

A male patient in his 40s, 175 cm tall, weighing 66 kg, had experienced pain from the lateral side of the right upper arm to the medial side of the forearm, and pain on the lateral side of the forearm, which was thought to be due to C6 and C8

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radiculopathy from a cervical disc herniation, since 5 years. He had received stellate ganglion block (SGB), brachial plexus block, nerve root block, and pulsed radiofrequency therapy, in addition to pharmacotherapy. Three years earlier, he underwent percutaneous disc decompression for C6/7 cervical disc herniation that presented as pain in the entire right hand, which was thought to be due to C7 radiculopathy. However, his C6 and C8 symptoms did not improve, and he continued to experience pain with an intensity of 8 on a numerical rating scale of 10, with a Neck Disability Index (NDI) of approximately 40%. Physical examination revealed signs of TOS, such as elevated shoulders and atrophy of the hypothenar muscles. He also tested positive for the Roos test, Morley test, and Allen test, which are provocation tests for TOS.[5–8] Chest X-ray showed no cervical ribs or tumors. Contrast-enhanced computed tomography scans did not show subclavian artery occlusion between the anterior and middle scalene muscles during upper limb elevation. Thus, imaging findings were not indicative of TOS. However, since the pain was relieved by local anesthetic injection into the anterior scalene muscle, we suspected that the pain and numbness were caused by TOS due to compression by the anterior scalene muscle. Therefore, SGB, brachial plexus block, and nerve root pulsed radiofrequency were performed as needed, but the pain relief was temporary. Regarding nerve root pulsed radiofrequency, the pain was most reproducible with application of pulsed radiofrequency to the T1 nerve root from among the right C6, C8, and T1 nerve roots, suggesting that the refractory pain was partly due to long-term compression of T1, accumulation of inflammatory substances, and adhesions. Hence, we decided to perform PEA. The procedure was performed using an 18G Touhy needle, approaching via the T2/3 interlaminar space using the loss-of-resistance technique. After reaching the epidural space, a spring guide catheter (Racz catheter®, Tokyo Iken Co., Ltd., Tokyo, Japan) was carefully inserted into the right T1 intervertebral foramen. After confirming the position of the T1 root with contrast injection, 5 ml of 0.18% ropivacaine was administered (Figure 1). Then, 5 ml of 5% saline was continuously administered over 30 min. Thereafter, the catheter was left in place, and the same administration was performed for a total of 3 days. The pain markedly improved after PEA (NRS 2–3/10). However, pain levels gradually increased 30 days post-PEA, returning to the original pain level (NRS 8/10) about 80 days after PEA. Nevertheless, the NDI remained low at 15%–20% (Figure 2). Since then, the patient has also undergone physical rehabilitation, with maintenance of NRS scores at 5–8/10.

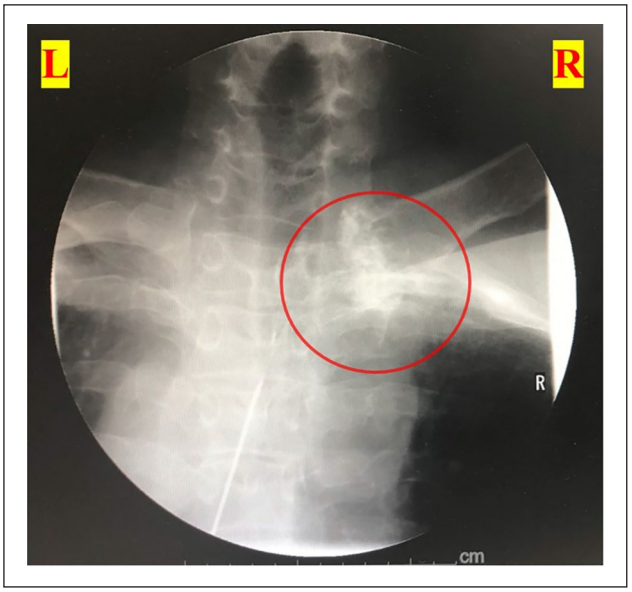

Figure 1. Fluoroscopic findings during PEA.
The T1 nerve root was visualized using contrast injection (red circle). After confirming the position of the T1 nerve root, 5 ml of 0.18% ropivacaine was administered. Then, 5 ml of 5% saline solution was administered continuously over 30 min.
PEA: percutaneous epidural adhesiolysis.

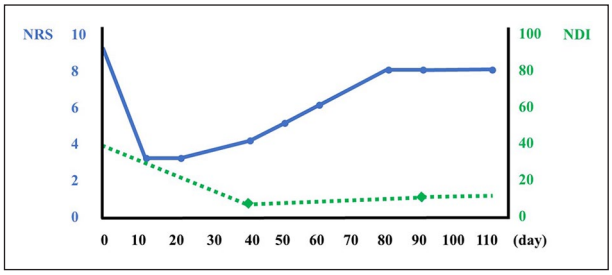

Figure 2. Course of NRS scores and NDI after PEA.
The pain gradually increased after day 30, reaching pre-PEA pain levels (NRS 8/10) about 80 days after PEA.
PEA: percutaneous epidural adhesiolysis; NDI: Neck Disability Index.

Discussion

This report describes a case of TOS due to brachial plexus entrapment by the anterior scalene muscle, in which PEA was effective for the treatment of refractory pain. TOS, which is caused by compression of neurovascular structures at the thoracic outlet, is often difficult to diagnose accurately because its symptoms can overlap with those of other conditions, such as cervical spine disorders.[9,10] In this case, C8 symptoms due to C7/T1 herniation and T1 symptoms due to T1/2 herniation were considered, but no organic abnormalities were evident on imaging. Previous reports have distinguished TOS from cervical spine disorders using brachial plexus block under fluoroscopy.[11] In this case, one of the treatment methods for TOS included the injection of local anesthetics into the scalene muscles, which served as diagnostic treatment, indicating that the scalene muscles were involved in the neuropathic pain of the brachial plexus.[12–14] The most intense pain was thought to originate from T1 among the other nerve roots in the brachial plexus, since T1 nerve root block produced the most reproducible pain relief. Moreover, performing T1 nerve root block temporarily alleviated C6 symptoms as well.

In this case, the pain refractoriness was thought to be due to long-term inflammation of the nerves caused by TOS, associated adhesions, and accumulation of pain substances, leading to the decision to perform PEA. PEA is a treatment particularly aimed at alleviating chronic pain.[15] The primary mechanisms by which this treatment improves pain are removal of adhesions and reduction of inflammation.[16,17] Additionally, injection of steroids during the procedure can help to relieve this pain. This is related to suppression of the activity of inflammatory substances by steroids and to reduction of edema in the affected nerve roots. These actions promote blood flow around the nerve roots and suppress ectopic discharges, further improving pain.[18]

In this case, PEA was performed using a spring guide catheter. This catheter, developed by Racz et al., is a blunt, flexible stainless-steel catheter. By passing it through an epidural needle, the catheter can be inserted and removed without damaging the surrounding tissues, and adhesions and scar tissue in the epidural space can be dissected. Moreover, by injecting local anesthetics and hypertonic saline through the catheter tip, liquid dissection is possible.[19] In this case, the NRS was maintained at 3–4/10 for about 30 days after PEA. Although pain levels, as represented by NRS scores, returned to baseline levels after about 80 days, the NDI, which evaluates the patient's self-assessed disability due to neck pain, remained improved to some extent. The factors contributing to the extended period of pain improvement in this case were thought to include washing out of the inflammatory substances and suppression of ectopic discharges by PEA. Additionally, reduction in pain levels enabled more active engagement in exercise therapy, which was considered a factor in prolonging the beneficial effects.[20] Since chronic pain patients generally develop a vicious cycle of pain,[21] breaking this vicious cycle was also considered a factor in the sustained pain relief in this case.

Conclusion

We experienced a case in which PEA was successful in treating refractory pain caused by TOS. PEA might work by washing out inflammatory substances and suppressing ectopic discharges, and might represent a potential treatment option for refractory TOS.

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Authors' contributions

RK, EH, HT, and HM contributed to pain management of the patient, conceptualization of the case report, and writing of the original draft. YI, MS, and AT edited the manuscript. KO was the overall supervisor of this case. All authors read and approved the final manuscript.

Availability of data and material

Not applicable.

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Ethics approval

Our institution does not require ethical approval for reporting individual cases or case series.

Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

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