

**FULL PAPER**

# Complication of interscalene block in pregnant woman with achondroplasia: A case report

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Interscalene blocks are commonly used in surgeries that involve the clavicle, shoulder, and upper arm. There is a lack of literature that explains the best anesthesia techniques for pregnant women with achondroplasia. A 28-year-old achondroplastic woman (35 kg, 110 cm), 30-31 weeks of pregnancy, planned elective ORIF of the right distal radius. The decision chosen after the preoperative evaluation was a peripheral nerve block anesthetic technique. In the operating room, routine non-invasive monitoring was established, and an interscalene block was performed using a 50 mm stimuplex needle under ultrasound guidance (golf-stick probe). A maneuver was performed towards the brachial plexus. After arriving at the C6-C7 sheath, twitching occurred in the bicep and the deltoid muscle area; 1 ml of 0,18% ropivacaine was injected to determine the spread of the local anesthetic, and then 9 ml was slowly added. Thereafter, the assistant evaluated the target block area and found that it was starting to feel numb but still felt painful. Then the needle is directed to the C5-C6 sheath, and 10 ml of ropivacaine is slowly injected. The patient feels short of breath, the respiratory rate increases and the patient becomes restless. the anesthetic technique was converted to general anesthesia. The operation took 4 hours and 30 minutes without additional opioid drugs. After surgery is completed, weaning from anesthesia begins. It was decided to extubate, but after extubation, the patient's respiratory effort increased with obstruction and desaturation. Reintubation was carried out and the patient was treated in the ICU.

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**KEYWORDS**

Anesthesia; achondroplasia; regional; interscalene block, case report.

**Introduction**

Achondroplasia is the most common type of dwarfism out of over 100 types. Achondroplasia is approximately 1 in 25,000 births, defined as disproportionate short stature, long-bone shortening, and macrocephaly [1]. Comorbidities that can

interfere with the anesthesia process include sleep apnea, airway disorders, obesity, and spinal stenosis [1]. Pregnant women with achondroplasia may face potential complications during surgery and anesthesia due to rib abnormalities, scoliosis, heart problems, pulmonary hypertension, and a difficult airway [1].

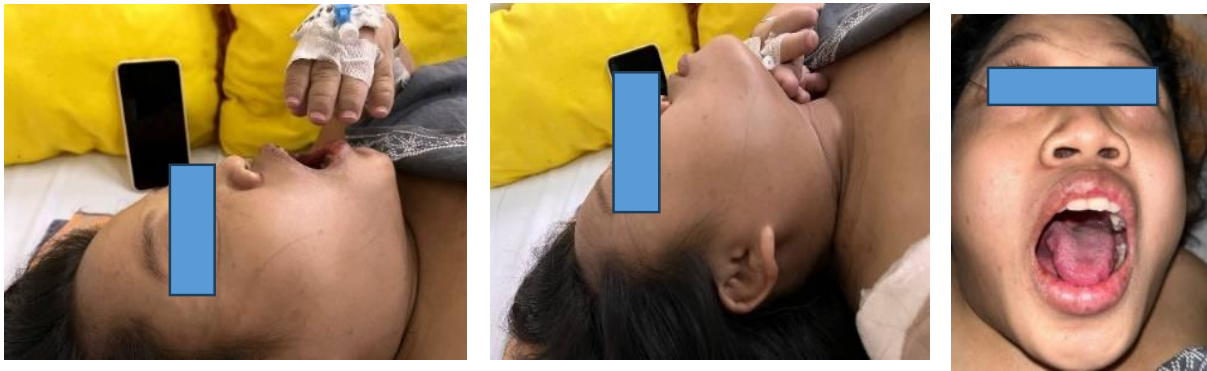
Interscalene blocks are the anesthetic choice in many surgeries, such as procedures in the clavicle, shoulder, and upper arm and arterio-venous graft insertion for hemodialysis. This technique offers several benefits over general anesthesia, such as decreased analgesia needed after surgery, faster recovery, shorter hospital stays, cost-effective, and avoidance of the side effects associated with general anesthesia [2,3]. The target of this technique is the C5-C7 brachial plexus, located lateral to the carotid artery and internal jugular vein, between the anterior and middle scalene muscles [4]. Structures adjacent to the target of this block include the recurrent laryngeal nerve, which innervates all laryngeal muscles except the cricothyroid muscle. Another structure is the phrenic nerve, which arises from C4 and gets some contribution from C3 and C5. It also functions to regulate the movement of the diaphragm. Complications of interscalene block arise from paralysis of the phrenic and recurrent laryngeal nerve [5].

Although it is usually considered safe, interscalene block carries the complication risk [6]. Complications occur because non-brachial plexus nerves (such as the phrenic nerve) are also blocked. Complications in the phrenic nerve are characterized by paralysis of the diaphragm, which results in a decrease in vital capacity of up to 30%. It is reported to occur up to 100% in local anesthetic drug volumes above 20 ml [7]. The next complication is paralysis of the recurrent laryngeal nerve. The incidence of paralysis of the recurrent laryngeal nerve in interscalene blocks ranges from 3-6%. Symptoms began to appear 30 minutes after the bolus of local anesthetic medication. The complaint that arises in the majority of cases is unilateral paralysis of the vocal folds, but in some of the reported cases, bilateral paralysis can occur and lead to acute respiratory failure [5]. Therefore, due to the risk of interscalene block intervention and the unique feature of

achondroplasia, there is a need for careful consideration and management. Furthermore, it should be noted that the patient is currently pregnant, which may heighten the likelihood of potential complications. The description of this case hopefully increases the awareness of possible complications of an interscalene block performed on a pregnant woman with comorbid achondroplasia.

### Case

28-year-old primigravida woman with a closed fracture of the left distal humerus, a weight of 35 kg, and a height of 110 cm was planned for elective Open Reduction Internal Fixation (ORIF) surgery of the distal humerus. The patient was hit by a motorbike from behind while driving 11 days ago. After the accident, the patient was conscious and immediately taken to the hospital. The patient had no history of previous illness or surgery. The patient is pregnant with a gestational age of 30-31 weeks. The patient also had abnormalities in the arms and legs since birth (short stature). On the preoperative examination, a Malampati score of 3 was found. She has a short neck and is unable to extend maximally (Figure 1). The respiratory examination found that the respiratory frequency was 22 times per minute, and oxygen saturation was 97% with room air. The kyphoscoliotic deformity was observed in the thoracolumbar spine (Figure 2). Blood pressure and pulse are within normal limits. She appeared calm with a VAS pain score of 1-2 in the right brachial area; a cast had previously been applied. On fetal examination, it was found the fetus was in normal condition. The laboratory tests showed mild hyponatremia with serum sodium of 134 mmol/L and elevated ALT and AST levels (108 and 88, respectively). The patient has consented to regional anesthesia, and also there might be a need for general anesthesia.



**FIGURE 1** Airway examination showed that patient had a short neck and limited neck movement



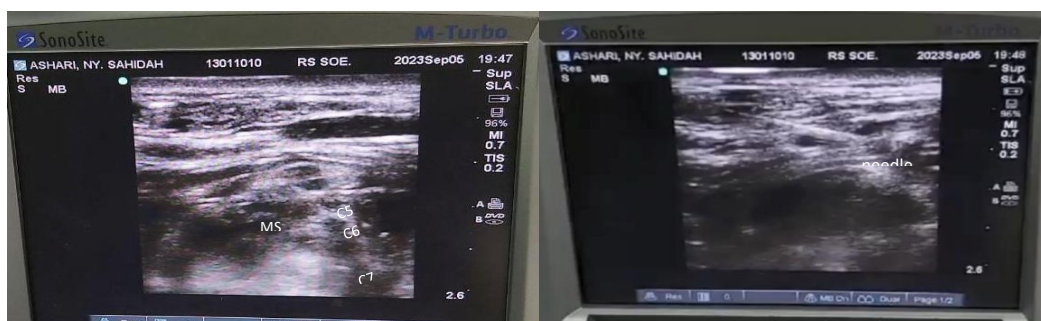
**FIGURE 2** Radiograph showing severe kyphoscoliosis involving the thoracic spine region

After initiating routine monitoring and the skin prepared with povidone iodine-alcohol, the interscalene nerve block was performed considering the achondroplastic stature using a combined ultrasound (golf stick probe + in-plane approach) due to the short stature probe and peripheral nerve stimulator technique with a 22G 50 mm insulated needle (Stimuplex® A). The probe was positioned in the transverse plane to identify the carotid artery. Once the artery was identified, the probe was moved laterally. The goal was to identify the scalene muscles and the brachial plexus sandwiched between the anterior and middle scalene muscles just below the level of

the transverse process of the seventh cervical vertebra. Ultrasound findings can be seen in Figure 3. After arriving at the C6-C7 sheath, twitching occurred in the biceps and deltoid area; the current was slowly decreased from 1.5 to 0.2 mA until the muscle twitch disappeared, and 1 ml of 0.18% ropivacaine was added to determine the spread of local anesthetic. After making sure it spreads properly, another 9ml was added slowly. Then the needle is directed to the C5-C6 sheath, and 10ml of ropivacaine is slowly injected. The patient feels short of breath, the respiratory rate increases and the patient becomes restless. the anesthetic technique was

converted to general anesthesia. The patient was preoxygenated with 100% oxygen, then 50 mcg fentanyl, 50 mg propofol, and 30 mg rocuronium were injected to facilitate endotracheal intubation. The patient was intubated with cuff tube no.7, lip margin 16cm. There was desaturation, and it improved after adjustments were made to the depth of the tube. The patient was positioned in lateral decubitus, and the operation continued. The operation lasted 4 hours and 30 minutes; the total bleeding was 100 ml, and a total of 500 ml of crystalloid fluid was given. no additional opioids were added during surgery. The patient is again positioned in neutral, weaning from anesthesia, and the ventilator begins. While the patient was still under sedation, the tidal volume reached 240-280 ml with a respiratory rate of 22 times per minute; neostigmine reversal 0.2 mg/kg was given with additional atropine sulfate, and then the patient is awakened until the patient is conscious. It was decided to extubate. In

immediate post-extubation evaluation, the patient's respiratory effort increased with signs of airway obstruction (see-saw breathing), and the saturation dropped quickly to below 90%. This condition did not improve with simple airway maneuvers. Then, reintubation was carried out. The intubation attempt failed with ETT number 7.0 but was successful with ETT number 6.5. The patient received treatment in the ICU. The patient underwent multiple Spontaneous Breathing Trials (SBT) during their time in the ICU. However, they did not meet the criteria for extubation. On the 5<sup>th</sup> day in the ICU, a cesarean section was performed to deliver the baby, with the hope that the patient's respiratory function would improve. However, after that, there was a complication of the VAP condition with the results of the *Acinetobacter baumannii* Multiple Drug Resistance Organism (MDRO) culture. The patient fell into septic shock, continued to deteriorate, and died on the 9<sup>th</sup> day of treatment in the ICU.



**FIGURE 3** Ultrasound image of Interscalene Block. The needle tip is positioned lateral to the upper roots of the brachial plexus. AS = anterior scalene muscle and MS = medial scalene muscle.

## Discussion

People with dwarfism have generally been divided into two categories: individuals with short stature with normal anthropometric proportions and those with disproportionate development, characterized by short limbs, and trunks, which are deformed in many cases [8,9]. Achondroplasia is the most common

cause of short-limbed, disproportionate dwarfism, with an estimated incidence of 1 in 20,000 births. Achondroplasia is caused by genetic mutations of fibroblast growth factor receptor-3, which affects bone growth [10]. Patients with achondroplasia are associated with several complications, including a difficult airway, laryngomalacia, difficulty in neuraxial technique, unpredictable



distribution of local anesthetic drugs, and impaired lung function [10]. Restrictive lung disease and pulmonary hypertension may occur secondary to thoracic scoliosis, airway obstruction, or sleep apnea [1]. Skilled anesthesiologists are concerned about difficulty with both mask ventilation and intubation due to characteristic airways in the dwarfism spectrum such as big head and tongue, limited head extension, cervical spine instability, and relatively underdeveloped pharynx [11-13].

The interscalene block that was chosen for this patient is known to have several complications, including paralysis in the phrenic nerve and recurrent laryngeal nerve [14]. In the normal population, the distance between the brachial plexus and the phrenic nerve at the level of the cricoid cartilage is only 0.18-0.2 cm, and the distance to the recurrent to the laryngeal nerve is 3cm. the structure that maintains the spread of the local anesthetic drug to the phrenic nerve is the thin fascia of the anterior scalene muscle, where the fascia is so thin that phrenic nerve paralysis often occurs. Meanwhile, reaching the recurrent laryngeal nerve is limited by the anterior scalene, prevertebral fascia, and pre-tracheal muscles [2].

Pregnancy and achondroplasia conditions cause changes in anatomical and physiological conditions that can increase the risk of complications in interscalene block. Pulmonary complications occur in the postoperative period. Pulmonary function (FVC and FEV<sub>1</sub>) could impair after the injections of local anesthesia [15]. Motor blockade of the diaphragm causes complaints of dyspnea and leads to compromise in oxygen saturation [16]. Impaired diaphragm function may have a problematic postoperative recovery and prolonged hospital length of stay [17,18].

Some steps that can be used to reduce complications from interscalene block. First, the volume of local anesthetic drugs should be

reduced. The recommended dosage is 15-20 ml, while the use of 10 ml of local anesthesia drugs can reduce the rate of phrenic nerve paralysis by up to 60% without interfering with analgesic efficacy for up to 24 hours [19]. Second, reducing the concentration of local anesthetic drugs can also reduce the risk of complications. Using bupivacaine 0.25% in 20ml volume, under the guidance of a nerve stimulator, can reduce the risk of phrenic nerve paralysis by up to 21% compared to using 0.5%, which results in 78% paralysis. When using 20 ml of ropivacaine, reducing the dose from 0.2 to 0.1% can reduce the risk of phrenic paralysis from 71% to 42% [20,21]. Other techniques that can reduce the risk of phrenic nerve paralysis are perplexus rather than intraplexus injection, injection below the C6 level, injection from the posterior direction, slow injection, low pressure, and titration [7].

In this patient, after receiving the second 10 ml injection (total volume 20 ml), the patient felt uncomfortable when breathing, and signs of respiratory obstruction appeared. During the reintubation, the vocal cord could not open properly, so there was difficulty in pushing the tube. We suspect that nerve paralysis has occurred due to 20 ml of local anesthetic medication in the interscalene block, which is not a small volume. Paralysis of the phrenic nerve also occurred. In normal patients, diaphragmatic paralysis due to interscalene block is often asymptomatic because there are still compensatory mechanisms. However, in this patient with comorbid dwarfism, scoliosis, and pregnancy, there was a decrease in lung capacity and intolerance to diaphragmatic paralysis. Difficult reintubation events also cause patients to experience laryngeal edema, which is worsened by complications of VAP with MDRO bacteria. The patient died on day 9 in the ICU due to complications from sepsis.

## Conclusion

Pregnancy with dwarfism comorbid increases the risks of anesthesia. In choosing an anesthesia technique, adjustments need to be made due to overall changes in anatomy and physiology. The choice of technique must lead to the highest margin of safety. Multidisciplinary preoperative discussions need to be carried out involving surgeons, anesthesiologists, pulmonologists, internists, and neonatologists. The benefit of interscalene block concerning postoperative analgesia should be weighed against the risks of potentially devastating complications.

## Acknowledgments

The author would like to thank all parties who contributed to the preparation of this article.

## Funding

This study received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Author contribution

AAK, CS, and BPS participated in writing the manuscript and reviewing the literature. AAK and KAF critically and linguistically revised the manuscript. BPS conceived and supervised the conduct of the study. All authors read and approved the final manuscript.

## Informed consent

The patient provided written informed consent for the publication of this case report and accompanying images. The editor-in-chief of this journal can review a copy of the written consent upon request.

## Conflict of Interest

The authors declare that they have no competing interests in this study.

## Data availability

All data generated or analyzed during this study are included in this published article.

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**How to cite this article:** Afi Adi Kirana, Christrijogo Sumartono, Kartika Afrida Fauzia, Bambang Pujo Semedi, Complication of interscalene block in pregnant woman with achondroplasia: A case report. *Journal of Medicinal and Pharmaceutical Chemistry Research*, 2024, 6(10), 1623-1630. **Link:** [https://jmpcr.samipubco.com/article\\_195909.html](https://jmpcr.samipubco.com/article_195909.html)