Ultrasound-guided spinal anaesthesia in a patient with achondroplastic dwarfism and scoliosis: a case report

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This article was published on 19 Sep 2023 at www.hkmj.org.

Hong Kong Med J 2023;29:459–61
https://doi.org/10.12809/hkmj2210169

Case presentation

In February 2019, a 27-year-old woman who was classified as American Society of Anesthesiologists class III and 8 weeks pregnant presented for elective therapeutic curettage and tubal ligation. She was 110 cm tall and weighed 30 kg. Her medical history was notable for thoracolumbar kyphoscoliosis, congenital dwarfism, and restrictive lung disease. The patient's medical history revealed that her previous two pregnancies were terminated due to shortness of breathing, reduced exercise tolerance, and the possibility that progressing pregnancy might create a life-threatening condition, first one in the 17th week and the other one in the 22nd week of pregnancy. Her airway assessment was normal but pulmonary function testing revealed a restrictive lung disease. Ultrasound-guided spinal anaesthesia was planned.

In the operating room, after standard monitorisation, she was placed in a sitting position. The midline of the spines and intervertebral disc space were impossible to palpate because of the severely rotated lumbar spines by marked scoliosis. Preprocedural ultrasound scan using curved array probe 2-5 MHz with LOGIQ e R7 ultrasound system (GE HealthCare, Washington DC, United States) for marking of insertion site were conducted in both paramedian longitudinal and transverse planes at different intervertebral levels.

In the scanning of the paramedian longitudinal plane, the transducer was placed over the lumbosacral spine approximately 2 cm lateral to the midline in a cephalad-caudad direction to find the appropriate lumbar interlaminar spaces (the ligamentum flavum–dura mater complex and posterior face of the vertebral body). The L2-L3 to L4-L5 interlaminar spaces were identified. In the transverse plane scanning, deeper structures were visible between the spinous process. In this view, the presence of bilateral transverse processes in the same plane was the clue for the correct intervertebral space. In this space, the vertebral column did not rotate due to scoliosis and was the most suitable intervertebral space for the needle puncture. The depth of the dorsal dura from the skin was measured as 3.73 cm in transverse view (Fig 1). The appropriate intervertebral space (L2-L3) was determined to be 2 cm laterally away to the right of the expected spinal midline as the intersection point of the line obtained from the paramedian longitudinal image and the line obtained from the transverse image (Fig 2).

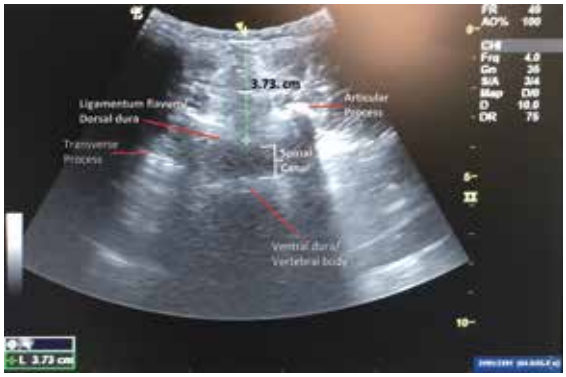

FIG 1. Ultrasound image in the transverse plane showing the L2-L3 intervertebral space and depth of the dorsal dura from the skin

After aseptic precautions, spinal anaesthesia was performed by using 5-mg 0.5% hyperbaric bupivacaine, with 10-μg fentanyl (1.2 mL in volume) at the L2-L3 interspace without any complications. The sensorial block was achieved up to the T4 dermatome level bilaterally and the patient was sedated with dexmedetomidine (200 mcg/2 mL). Motor functions regressed to her basal level 4 hours after the initial intrathecal injection and the sensory component of the block returned by 5 hours.

The patient was discharged on postoperative day 2 uneventfully without postdural puncture headache and back pain. A follow-up 1 month after the surgery showed no further deterioration in her neurological condition.

Discussion

This case illustrates two important points. First, the transverse plane image shows the rotation point of the vertebral column better than the longitudinal

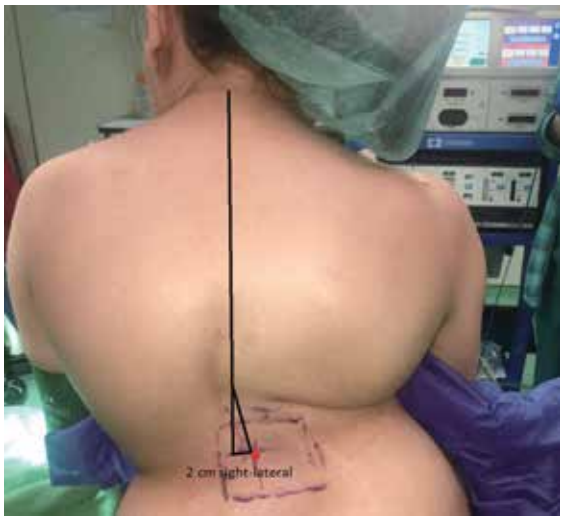

FIG 2. Puncture point of lumbar puncture (red four-point star) from the posterior view of the patient, which is determined as 2 cm laterally away to the right of the expected spinal midline as the intersection point of the line obtained from the paramedian longitudinal image and the line obtained from the transverse image

plane; thus, this makes it easier to decide on the most appropriate intervertebral puncture point in the placement of a spinal block in a patient with abnormal spinal anatomy. Second, this case highlights the value of a systematic approach and an individual risk-benefit ratio on a case-by-case basis when performing neuraxial anaesthesia in patients with severe scoliosis and dwarfism.

Shiang et al[1] demonstrated that nearly all cases of achondroplasia are autosomal dominant and most of those with achondroplasia will have a normal or near-normal life expectancy. Therefore, they may live long enough to experience anaesthesia for various reasons. Clinical features that may be important for anaesthesia management are midfacial abnormality, craniocervical constriction, thoracolumbar kyphosis, lumbosacral spinal stenosis, and cardiac and pulmonary abnormalities.

The patient whom we have described with achondroplastic dwarfism resulting severe in scoliosis and moderate restrictive lung disease had a potential risk for general anaesthesia due to instability of the cervical spine, limited respiratory reserve, and predisposition to the risk of malignant hyperthermia. On the other hand, scoliosis and spinal stenosis might further complicate patient management with neuraxial anaesthesia technique.[2] In our case, the patient's previous two pregnancies were terminated without using any anaesthetic methods. The terminations were performed by medical abortus (200 mcg oral and vaginal misoprostol) with intramuscular meperidine analgesia. For the intervention in our case, spinal anaesthesia was planned after mutual consent had been achieved with the patient and the medical team. Because of spinal deformity of the patient, spinal anaesthesia was predicted to be challenging even with ultrasound assistance.[2,3]

The drug and the dosage choice for spinal anaesthesia in achondroplastic patients with severe scoliosis may be of concern, as an unpredictable spread of drug may contribute to a high blockade that could be catastrophic in patients with a difficult airway and limited pulmonary reserve. It has been reported that a satisfactory block level was obtained with an administration of 0.06 mg/cm height of intrathecal bupivacaine.[4] In the present case, as the height of the patient was 110 cm and the body mass index was 24.8 kg/m^2, 5-mg bupivacaine and 10-μg fentanyl (1.2 mL in volume) were administered intrathecally, and a T4-level block was obtained. For local anaesthetic for spinal anaesthesia in these patients, we do not recommend dosages >0.06 mg/cm height to avoid complications caused by abnormal block levels.

In our patient in whom we had predicted difficult spinal anaesthesia, we preferred to use ultrasound before the procedure for landmark identification. Numerous reports indicate that this application facilitates technical performance in obstetric and paediatric patients and in patients with difficult spinal anatomy.[5] However, real-time ultrasound guidance may provide additional advantages by taking into account the positional changes of the patient during the procedure. Ravi et al[6] compared the efficacy of real-time ultrasound-guided paramedian approach and preprocedural ultrasound landmark-guided paramedian approach in obese patients. They determined that the time taken for the identification of the space and for successful lumbar puncture, and the number of attempts and passes was more in the latter group as compared to the former group.[6] Although it is not technically difficult to recognise spinal spaces with real-time ultrasonography, the success rates for spinal anaesthesia were similar for both techniques.[6] Real-time ultrasonography may be a better alternative as it can show all structures that cannot be observed during the procedure with 'pre-procedural ultrasonography'.

An experienced practitioner can achieve >90% success rate in identifying the epidural space in difficult situations using ultrasonography, as in the current patient with difficult spinal anatomy.[5] In our experience, a single screening method of ultrasound imaging in the transverse plane gives working knowledge about the anatomical structures. Thus, the asymmetry of structures on the two sides of the spinal canal, mainly the articular and the transverse

processes in the interspace, can be used as a guide to determine the level of the rotation on the spinal column. In our patient, no anatomical landmarks were identifiable, and it was impossible to detect the level of rotation of scoliosis. By using ultrasound, we precisely determined the L2-L3 intervertebral space available for the placement of spinal block and also the depth of the dorsal dura from the skin that was measured as 3.73 cm in the transverse view.

In conclusion, ultrasound-guided spinal anaesthesia is feasible and can greatly facilitate a spinal technique, especially in the transverse plane, in the presence of severe scoliosis with achondroplastic dwarfism.

Author contributions

The author contributed to the concept or design of the study, acquisition of the data, analysis or interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. The author had full access to the data, contributed to the study, approved the final version for publication, and takes responsibility for its accuracy and integrity.

Conflicts of interest

The author declares no conflicts of interest.

Acknowledgement

The author thanks Dr Coskun Salman and his team at the Department of Obstetrics and Gynecology, Hacettepe University for their sincere support of taking care of the patient during and after the operation.

Funding/support

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

Ethics approval

The patient was treated in accordance with the Declaration of Helsinki and has provided informed consent for the publication of the report along with the data, radiological images, and photographs.

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