Case Report

Ultrasound-guided continuous spinal anesthesia for cesarean section in a parturient with scoliosis corrected with Harrington's rod surgery

ABSTRACT

With rapid improvement in healthcare in Saudi Arabia, increasing number of women with surgically corrected kyphoscoliosis are likely to present for cesarean section (CS) or vaginal delivery requiring anesthesia or analgesia. Despite the surgical correction, these patients have poor cardiopulmonary reserves which increase the risks associated with general anesthesia. Whereas altered vertebral anatomy from previous surgery and the presence of metal work in spine make performing of regional anesthesia (RA) difficult and unpredictable, we report anesthetic management of such a patient who underwent CS using continuous spinal anesthesia technique. Challenges of placement of a spinal catheter in such a patient are discussed, and use of ultrasonography to circumnavigate these challenges is described. We propose that ultrasound can prove extremely valuable in performing of RA in patients with surgically corrected kyphoscoliosis. We could not find a similar case report from Saudi Arabia in the published literature.

Keywords: Cesarean; scoliosis; ultrasound

Introduction

Scoliosis is a rotational deformity of the spine and rib cage resulting from disruption of balance between structural and dynamic components of musculoskeletal elements of vertebral column.[1] Anatomically, it is characterized by a lateral curvature and rotation of involved vertebrae along the vertical axis. Scoliosis is associated with restrictive lung disease, hypoxemia, and pulmonary hypertension; if left untreated, it could progress to respiratory failure and death.[2] Although severe scoliosis is uncommon in women of childbearing age, women with surgically corrected scoliosis are presenting in labor ward, either for delivery or cesarean section (CS), with increasing frequency.[3] Unfortunately, there is a scarcity of anesthetic literature to inform safe and effective management of such patients, though both regional anesthesia (RA)[3] and general anesthesia (GA)[4] are employed. To the best of our knowledge, this is the first reported case, in the Kingdom of Saudi Arabia, of anesthetic management of CS in a woman with scoliosis, corrected with Harrington's rod surgery.

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A 36-year-old, wheelchair-bound, 28-week primigravida presented with pregnancy complicated by recurrent chest infections and progressive worsening of dyspnea requiring

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supplemental oxygen and multiple hospital admissions. Her recurrent chest infections were attributed to her idiopathic kyphoscoliosis which continued to deteriorate slowly despite corrective surgery (Harrington's rods) performed at the age of 15 years. Unfortunately, her old notes were not available to fully evaluate her precorrection severity of scoliosis and response to surgical correction. She denied knowledge of any previous anesthetic or surgical complications. Following her detailed medical and obstetric evaluation, for maternal safety, it was decided to proceed with the delivery of baby by CS, and she was referred for preanesthetic assessment accordingly.

On assessment, she weighed 53 kg and was estimated to be 1.5 m tall. She was dyspneic but maintaining SpO_2 of 95% on oxygen 2 L/min through nasal cannulae. On examination, she had marked thoracolumbar kyphoscoliosis and lumbar lordosis, and old surgery scar was visible extending from upper thoracic to lower lumbar region. She was unable to flex thoracic or lumbar spine due to the presence of Harrington's rods. Chest X-ray [Figure 1] revealed S-shaped deformity of trachea indicative of difficult airway. Lower end of Harrington's rod and lumbar vertebrae could not be visualized as those were obscured by the abdominal shield used to protect the fetus from radiation.

Chest X-ray demonstrated tracheal and spinal deformity as well as Harrington's rods but obscured the lower end of the rods due to the pelvic shield [Figure 1].

Bedside ultrasonography of the spine was performed which revealed acceptable acoustic windows and returned good dural signals at L2–L3, L3–L4, and L4–L5 vertebral interspaces; the lower pole of the Harrington's rods was seen at L1–L2 vertebral interspace [Figure 2].

Parasagittal ultrasound in longitudinal section demonstrating the lower end of Harrington's rod and acoustic signals from the dura [Figure 2].

Considering her clinical condition and fetal prematurity, CS under RA was considered safer than GA for both mother and the baby. After careful consideration of risks and benefits and discussion with the patient, ultrasound-assisted placement of continuous spinal anesthesia (CSA) was planned to mitigate the challenges posed by *in situ* metal work, scarring from previous surgery, the presence of exaggerated curvature in her spine, and anticipated difficulty in positioning the patient for spinal catheter placement.

After obtaining informed consent and institution of monitoring including pulse oximeter, electrocardiogram, and arterial line (for invasive blood pressure monitoring and arterial blood gas sampling), and ultrasound (curved array probe 2–5 mHz, Sonosite®, MicroMaxx, Bothwell, WA, USA) assisted prepuncture marking of skin were done and distance to dorsal dura from skin was measured. In right decubitus position and under strict aseptic conditions, a 20-gauge epidural catheter was placed into L3–L4 intrathecal space through an 18-gauge Tuohy needle uneventfully in the first attempt. After positioning the patient supine on three pillows to facilitate breathing and to limit the cephalad spread of the injectate, a mixture of 0.5% heavy bupivacaine 20 mg total and fentanyl 15 μg was administered intrathecally through the spinal catheter in four equal aliquots, each 5 min apart. She was monitored for hypotension, bradycardia, or breathing deterioration after each aliquot. After 25 min, a T6 level block to light touch was achieved without any complications, and the surgeons proceeded with CS accordingly. CS was completed uneventfully; intrathecal catheter was removed, and the patient was monitored in intensive care unit for 24 h.

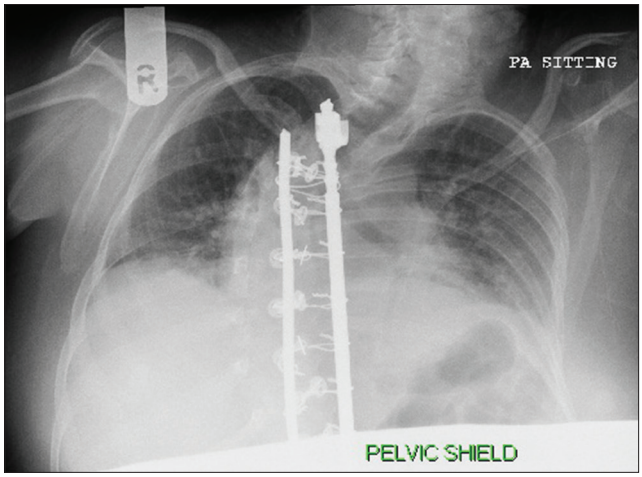

Figure 1: Chest X-ray

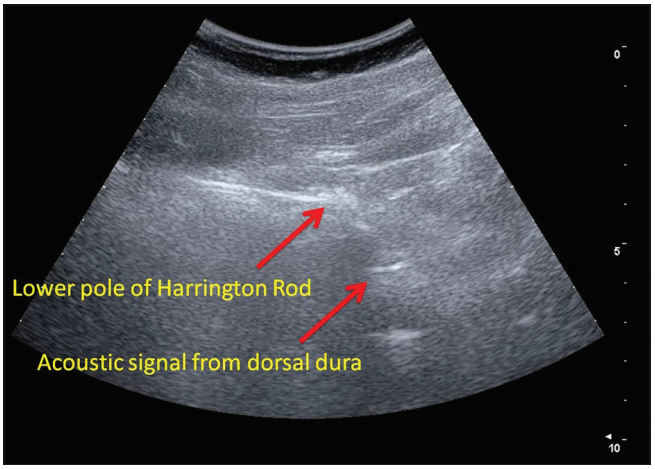

Figure 2: Spinal ultrasound

Multimodal postoperative analgesia was provided. She had an unremarkable recovery and was discharged home on day 7.

Discussion

The reported prevalence of idiopathic scoliosis in general population depends on Cobb's angle used to define scoliosis. When a Cobb angle of 10° is used, in Saudi Arabia, scoliosis affects up to 1.6% of the adult population;[5] but prevalence drops to 0.37% for Cobb's angle 20° or more[6] with a female preponderance of three to one.[7] It is well established that surgical correction of scoliosis significantly improves patient's anatomical appearance and quality of life but is usually complicated by incomplete correction or continued disease progression.[8] In Saudi Arabia, there is concerted effort to reduce surgical waiting time for scoliosis patients[9] meaning that more and more women with surgically corrected scoliosis are likely to present in maternity units requiring labor analgesia or anesthesia for vaginal delivery or CS. Moreover, in women with surgically corrected scoliosis pregnancy may exacerbate cardiopulmonary symptoms; maternal morbidity and mortality correlate well with prepregnancy functional status and risk of CS increases by 2.5-fold.[10] This applied gravely to our patient in whom continuation of pregnancy was considered unsafe for the mother due to worsening of cardiopulmonary functions.

GA is indicated when there is a maternal preference, difficulty/failure in performing RA, or inadequacy of sensory block achieved.[11] However, in our patient, the presence of difficult airway anatomy, i.e. S-shaped tracheal deformity and severe cardiopulmonary compromise increased the risks associated with CS under GA.[4] All variants of RA, single-shot spinal, CSA, epidural and combined spinal epidural, have been employed in patients with surgically corrected,[3] and uncorrected,[12] scoliosis. However, abnormal vertebral anatomy, presence of metallic rods, scar tissues, and distortion of epidural space do make performing of RA technically difficult and are frequently associated with high failure rate,[13] patchy or inadequate sensory block,[14] exaggerated hypotension,[15] and high accidental dural puncture (ADP) rate.[13] CSA remains the most commonly used RA technique for CS in patients with surgically corrected scoliosis.[3,15,16] CSA offers the ability to establish the block gradually (avoiding hypotension), use of additional dose (avoiding patchy or inadequate block), and avoidance of ADP. Nonetheless, performing of CSA in such patients remains technically challenging.

Despite the fact that use of ultrasound in performing of RA in obstetric patients is now well established[17] and ultrasound-assisted RA by an experienced operator can achieve a success rate of >90% (compared to 32% for novices),[18] experience with ultrasound-assisted RA in patients with surgically corrected scoliosis is limited to a few case reports only.[10,14] Ultrasound facilitates estimation of the depth of ligamentum flavum/dorsal dura complex, identification of midline, and visualization of Harrington's rods in such patients.[10] In Saudi Arabia, to the best of our knowledge, this is first reported use of ultrasound to assist performing of RA in patients with abnormal spinal anatomy.

Ultrasound-assisted CSA appears simple but it has limitations, and its effectiveness is hugely dependent on operator experience and expertise in this technique. Harrington's rods placement involves removing the spinous processes and coupled with significant scarring in the area, visualization of vertebral landmarks, and soft-tissue structures become obscured on ultrasound leaving the metallic rods as the most recognizable feature in the parasagittal plane(s). Caudal to the lower poles of these rods, the sonoanatomy of the vertebral column may still be intact, and evaluation may be possible for planning the access for the central neuraxial blockade. This should be borne in mind when reproducing this technique.[10]

In our patient, imaging in the parasagittal plane revealed lower end of the Harrington's rod at L1–L2, and in transverse plane, spinous processes of L3, L4, and L5, along with acoustic windows in between and ligamentum flavum/dorsal dura complex, indicating structural integrity of spinal anatomy below the lower poles of Harrington's rod. Accordingly, we decided to perform CSA at L3–L4 interspace. We favored 18-gauge Tuohy needle and corresponding 20-gauge epidural catheter over spinal microcatheters for two reasons: familiarity with the needle and good feel of the structure when piercing through soft tissues. Moreover, we believe that stiffness of 20-gauge epidural catheter offers added advantage of ease of placement and reduced risk of breakage. However, concerns about increased risk of postdural puncture headache (PDPH) with use of Tuohy needle were addressed by the fact that intrathecal epidural catheters have mitigating effect on PDPH.[19]

The majority of RA procedure will continue to be performed by employing standard "blind" methods. However, this case illustrates the benefit of ultrasound in performing of RA in a patient with abnormal spinal anatomy. In authors' opinion, in Saudi Arabia, where acquisition and maintenance of skills to perform ultrasound-assisted RA is currently unappreciated, addition of this skill to the armamentarium of obstetric anesthetists is now highly warranted.

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Conflicts of interest
There are no conflicts of interest.

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