



Ultrasound Guided Erector Spinae Plane Block to Facilitate the Traditional Wake-Up Test in Scoliosis Correction Surgery

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Abstract

Background: Corrective surgery for scoliosis is extensive. Intraoperative neuromonitoring techniques are essential including the most basic “wake-up test” which is simple old technique and can be used if the recent evoked potentials are not available. Erector Spinae Plane block ESPB may facilitate the test by making the patient easily arousable and increasing patient comfort.

Methods: Twenty-eight adolescents [Age 10-18 years] were randomly included into one of two equal groups. The Block group received intraoperative bilateral single injection ESPB 0.5 ml/kg of bupivacaine 0.25% after induction. The Control group received intraoperative intravenous fentanyl only and postoperative baseline morphine infusion. We assessed the duration of the wake-up test.

Results: The Block group had shorter duration in the Wake-up test than the Control group. [minutes as median (quartiles); Block: 20 (16,25); Control: 25 (20,30), P value 0.046].

Conclusion: ESPB is simple and can facilitate the wake-up test by decreasing opioid consumption, so the patient is rapidly aroused and his response to motor requests will be reliable in addition to being aware without pain.

KeyWords: Scoliosis; Erector Spinae; Spine; Wake-up; Ultrasound.

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Introduction

Adolescent idiopathic scoliosis is the most common form of scoliosis and is most frequent in girls. If spinal curvature progresses, there is an increase in cosmetic deformity, back pain and chest cavity narrowing [1]. Surgery is indicated once the curvature is $>40^\circ$ Cobb's angle. A posterior approach is most commonly utilized. The aim of spinal deformity surgery is to correct the curve and fuse the spine, improving posture and halting the progression of pulmonary dysfunction.

Good postoperative analgesia is essential to allow frequent physiotherapy and early mobilization, and so reduce the risk of respiratory complications.

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Materials and Methods

Because scoliosis correction requires operation near the spinal cord, and thoracic and lumbar nerve roots, neuromonitoring techniques are used including the most basic “wake-up test” which is simple old technique and can be used if the recent evoked potentials are not available. Erector Spinae Plane block (ESPB), described by Forero in 2016 can add to the multimodal approach for perioperative pain management with decreasing the opioids requirement, improving recovery [2].

Methods

This prospective, randomized, double-blind study was conducted in Kasr Al-Aini Children’s hospital (AboulRiesh), Cairo University.

Twenty-eight patients of both genders, aged 10–18 years (American Society of Anesthesiologists physical status of I or II) who were scheduled to undergo dorsal spine instrumentation for scoliosis and had agreed to receive either an ESPB and/or routine intravenous opioid analgesia were enrolled.

All patients were assessed clinically and investigated for exclusion criteria which included: refusal of block, bleeding tendency with prothrombin concentration PC less than 75 % or platelet count less than 150,000/ μ L, chronic opioid dependence, skin lesion, wounds or infection at the puncture site or known allergy to local anaesthetic drugs.

A computer-generated sequence of random numbers and a sealed envelope technique were used to randomize the patients. Participants and those assessing/analyzing the outcome(s) were blind to group assignment.

In the preoperative visit, patients were informed of the wake-up test; during surgery they will be requested to move legs while sleeping prone and feeling minimal pain.

General anesthesia was induced in both groups using propofol 2.5 mg/kg over 20-30 seconds, atracurium 0.5 mg/kg to facilitate endotracheal intubation and fentanyl 1 μ g/kg. Anesthesia was maintained using isoflurane (1 MAC) and atracurium infused as 0.5 mg/kg/hr. Then patients were turned to the prone position.

In the block group ESPB, the back region was disinfected and sterilized. The ultrasound linear frequency 6-13 MHz probe was used. The probe was placed in a longitudinal position 2-3 cm lateral to the vertebral column. The transverse processes of the vertebrae near the mid-level of surgery, the erector spinae muscle and the other back muscles were identified. A 22G needle was inserted in an in-plane technique until bone contact with the top of the transverse process is reached. After slight retraction of the needle, 0.5 ml/kg of bupivacaine 0.25% was injected between erector spinae muscle and transverse process, taking in consideration not exceeding the toxic dose of bupivacaine; 2 mg/kg. The same procedure was repeated on the contralateral side. Failure of block was considered if there is increase in heart rate and or arterial blood pressure by more than 20 % of baseline values 20 minutes after local anaesthetic injection and patient was excluded from the study.

In the control group, patients received another dose of fentanyl 1 μ g/kg 1 minute before start of skin incision.

During the wake-up test, the patient is awakened after correction rod placement to assess basic lower extremity nerve function. If neurological function is deemed intact, the patient’s anaesthetic is deepened and the operation completed. In order to be reliable, the patient must be able to follow simple motor commands like opening eyes or closing hands, to make sure of patient awareness, then simple leg commands like flexing knees and feet. Duration of the test was recorded in both groups.

After end of surgery and emergence from anesthesia, patients received continuous intravenous morphine. In both groups, if the analgesia was inadequate in the form of increase in heart rate and or arterial blood pressure by more than 20% of baseline values during surgery, this warranted the administration of intravenous fentanyl (0.5 μ g/kg).

Results

1- Demographic data:

As regards to age, sex and body weight, there was no statistically significant difference between the two groups.

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Table (1). Demographic data: age, sex and body weight

	Control group (n=14)	ESPB group (n=14)	P value
Age (years)	10.8 (1.9)	11.3 (1.9)	0.450
Female sex (%)	13 (93)	13 (93)	1
Weight (kg)	36.6 (6.1)	32.9 (5.8)	0.097

•Data presented as mean (standard deviation) and frequency (%)

•P value <0.05 was considered statistically significant

2- wake-up test

The Wake-up test had shorter duration in the GE with statistical significance (P value 0.046).

Table (2). Intraoperative data

	Control group (n=14)	ESPB group (n=14)	P value
Wake-up test time (minutes)	25 (20,30)	20 (16,25)	0.046*
Number of fixed levels	7.7 (1.2)	7.7 (1.9)	1
Duration of surgery (minutes)	331 (42)	323 (53)	0.663

Data presented as mean (standard deviation) and median (quartiles)

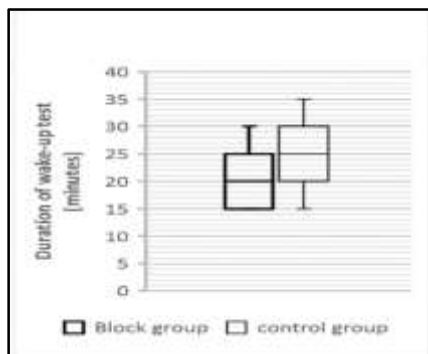


Figure (1): Wake-up test duration (minutes); data is presented as median & quartiles

Discussion

Scoliosis is lateral deviation and rotation of thoracolumbar spine leading to deformity. Rotational deformity usually accompanies and adds to the complexity of the condition.[1]

The surgery is extensive. For posterior fusion the skin and supraspinous ligament are incised and the para-spinal muscles reflected. The spinous processes and interspinous ligaments are removed and the facet joints destroyed. After instrumentation and correction of deformity, bone graft is applied to the entire fusion area. The instrumentation is designed to provide stability allowing early postoperative

mobilization before bony fusion is complete. [4]

Because scoliosis correction requires operation near the spinal cord, and thoracic and lumbar nerve roots, various techniques for intraoperative monitoring of nerve function have been developed. The goal of intraoperative neuromonitoring is to identify disruption in nerve signals quickly so that surgical adjustments can be made before the final spinal column configuration is set. Specialised spinal cord function monitoring can be achieved by measuring evoked potentials.

The most basic intraoperative test of nerve function is the wake-up test which is used in settings where neuromonitoring may not be available. In this test, the patient is awakened after correction rod placement to assess basic lower extremity nerve function. If neurological function is deemed intact, the patient's anaesthetic is deepened and the operation completed. In order to be reliable, the patient must be able to follow simple motor commands.

Anaesthetic technique should allow for rapid wake-up during and after the operation, and may be achieved with careful titration of an opioid-based general anaesthesia. The Erector spinae plane block can facilitate the test by decreasing opioid consumption, so the patient is easily aroused and his response to motor requests will be reliable in addition to being aware without pain.

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Conflict of interest

Authors declare no conflict of interest.

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