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Short Communication

Enhancing surgical outcomes of posterior iliac bone harvesting through a pivotal modification

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Abstract Traditionally, patients are positioned in the prone position to access the donor site during the posterior iliac bone graft harvesting procedure. However, this well-established method is associated with complications such as pressure injuries, displacement of the endotracheal tube and intravenous catheter, and blindness. Moreover, the process of turning patients 180° between the supine and prone positions is both laborious and time consuming. However, no updates have been made in the approaches published in the literature to counteract these problems. Therefore, to overcome these challenges and improve patient outcomes, we proposed a pivotal modification: change prone position to the lateral decubitus position. This approach allowed us to effectively avoid the aforementioned complications. In addition, this modification offered significant advantages, including ease of implementation and timesaving benefits. The article presented results of the modification and a comprehensive evaluation of clinical and anesthetic considerations comparing the two methods.

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Introduction

The posterior iliac crest is an ideal region in cases that require a significant volume of autogenous bone graft. When procedures are correctly performed, posterior iliac crest can provide up to 100 c.c. of uncompressed corticocancellous bone in a healthy adult. The donor site complications are usually minor and temporary, such as wound pain, infection, hematoma, paresthesia, and scarring. Iliac crest fracture and abdominal contents herniation are uncommon complications.¹

While performing the classic harvesting process in the prone position, there are some clinical and anesthetic concerns. Position-related injuries have been mostly associated with this position. This position warrants more staff members to facilitate prone positioning than other positions. Complications related to this position include cervical spine, nerve, and pressure-related injuries. Nerves that can be injured include the brachial plexus, ulnar nerve in the cubital tunnel, and axillary neurovascular bundle by axial pressure from the humerus. Pressure-related injuries are barotrauma due to endotracheal tube kinking, blindness from direct pressure on eyeballs, and skin pressure sore at breasts, genitalia, iliac crest, or any other bony prominences.^{2,3} Obese patients are at higher risk of these injuries.

It is also crucial to avoid the airway device, intravenous line, and Foley catheter from getting dislodged during the transition from the supine position to the prone position following endotracheal tube intubation. After the procedure is completed, patients must be turned over into the supine position again for further oral or maxillofacial surgery.

In summary, the prone position seems time consuming, unsafe, and labor intensive for performing the posterior iliac bone grafting procedure. Surprisingly, to the best of our knowledge, no updated approaches have been published to counteract these problems.

Accordingly, we tried to modify posterior iliac bone crest harvesting procedure using the lateral decubitus position. Surgical advantages and remarkable efficacy of this bone harvesting approach were evident, with no adverse events. The study presented the results of the successful utilization of this modification. Furthermore, we conducted a comprehensive evaluation of clinical and anesthetic considerations and compared the traditional prone position with the proposed lateral decubitus position. We aimed to provide medical professionals with a robust analysis that will facilitate them in performing safe and efficient procedures in this specialized field.

Materials and methods

A 22-year-old male who was pathologically diagnosed with unicystic ameloblastoma in the mandible underwent tumor excision and posterior iliac bone graft reconstruction in our department in October 2022. After endotracheal tube intubation in supine position, the patient was kept in the lateral decubitus position and solid support was provided through an adjustable device and sheets, which acted as cushions. The head was supported by a doughnut roll and

kept in a neutral position. The legs were slightly flexed with a pillow placed between the knees. To release the pressure, gel pads were kept under the chest wall (slightly caudal to axilla) and ankle. Both hands and arms were extended forward with a quilt in between (Fig. 1A). Important anatomical landmarks were marked with a surgical marking pen (Fig. 1B). The conducting surgeon and instrumentation table were present on the backside of the patient, whereas the first assistant was present on the front side. The following harvesting procedure could be performed in a similar manner as it is performed in the prone position (Fig. 1C). Articles listed in the PubMed and UpToDate databases were reviewed to compare clinical and physiological considerations related to patient positioning during general anesthesia.

Results

The surgical field and access to the site were sufficient for the surgeon and assistants to perform posterior iliac crest harvesting. The transition from the lateral decubitus to

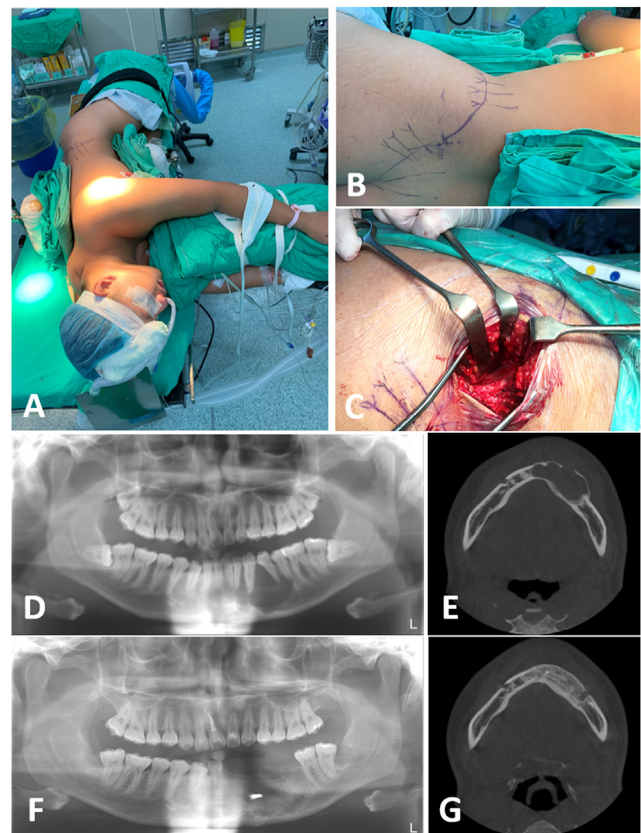


Figure 1 (A) The patient was prepared in a lateral decubitus position. (B) Outline of the posterior iliac crest, posterior superior iliac spine, and superior and medial cluneal nerves were marked. (C) The operative field and surgical access were sufficient for harvesting the posterior iliac bone graft. (D and E) Panoramic film and computer tomography showed ameloblastoma at the left mandibular body. (F and G) Good bone healing after ameloblastoma excision and posterior iliac bone grafting was noted.

supine position after wound closure required the assistance from only three staff members (including one from anesthesia team) and took <1 min. Additional surgical tables were not required, unlike when the procedure is performed in the prone position.

The patient recovered uneventfully after the surgery without pressure sore or catheter dislodgement. He was discharged on the 4th postoperative day. The patient experienced mild wound pain and paresthesia, which gradually subsided during the follow-up period. The evaluation performed at postoperative 6th month revealed remarkable bone regeneration using panoramic films and cone beam computer tomography images taken before (Fig. 1D and E) and after (Fig. 1F and G) the surgery. There was no permanent complication.

Previous studies suggested that the lateral decubitus position was more advantageous than the prone position, as it does not cause blindness and less pressure-induced injuries. Moreover, the transition from the supine to the lateral decubitus was simpler than to the prone position. The differences and complications between the prone and lateral decubitus positions are summarized in Table 1.

Discussion

Posterior iliac bone harvesting is a promising surgical procedure in obtaining a considerable amount of autogenous bone graft. However, the conventional approach of using the prone posture during the bone harvesting procedure has several drawbacks. Therefore, it is necessary to investigate whether a different posture can be used while harvesting posterior iliac bone graft. Our simple modification of using the lateral decubitus position is an efficient alternative that leads to less pressure-related injuries and avoids endotracheal tube or catheter dislodgement.

However, the physiological changes and complications caused by various positions should be considered during general anesthesia. The optimal position and postural change for sequential surgery are determined by the individualized procedure, physiologic changes, and avoidance of potential complications, depending on the preoperative discussion and consensus of the surgical and anesthesia teams.

In terms of pressure-related injuries, the prone position is associated with pressure sores at breasts, genitalia, iliac crest and injuries to brachial plexus, ulnar nerve, and axillary neurovascular bundle. Additionally, corneal abrasions and devastating postoperative visual loss have been reported. The lateral decubitus position can endanger hip, elbow, ankle and brachial plexus if protective pads and arms are not properly placed.⁵ Nevertheless, these issues are easily monitored, and the eyes are free of direct pressure in the lateral decubitus position.

From a physiological cardiopulmonary perspective, lateral decubitus position can reduce cardiac output, impair venous return, and lead to ventilation–perfusion mismatch. On the other hand, the prone position may affect venous return and aortocaval compression contribute to decreased

Table 1 Comparison of the differences and complications between the two positions.

	Prone position	Lateral decubitus position
Ocular complications	Corneal abrasion	Corneal abrasion
Nerve injury	Eye blindness Brachial plexus Ulnar nerve Axillary neurovascular bundle	Brachial plexus Common peroneal and saphenous nerve
Pressure sore	Breasts, Genitalia, Iliac crest Any other bony prominences	Bony prominences at hip, elbow, and ankle
Cardiovascular physiologic change	Vena compression Decrease venous return Decrease cardiac output Hypotension	Blood pool in dependent lower extremities Decrease venous return Decrease cardiac output hypotension
Pulmonary physiologic change	Better ventilation –perfusion Increase FRC Increase PaO ₂	Ventilation –perfusion mismatch
Change surgical table	Twice during turn-over	No need
Labor and time required for posture change	More	Less
Risk of endotracheal tube, intravenous line, foley catheter dislodgement	Higher	Lower

FRC: functional residual capacity; PaO₂: arterial partial pressure of oxygen.

cardiac index and result in hypotension.^{3,4} However, it provides better ventilation–perfusion status, functional residual capacity, and arterial partial pressure oxygen with unchanged chest wall and lung compliance. In patients with poorer lung function, traditional prone position would provide better oxygenation.

Finally, life-supporting routes displacement is also a major issue.⁵ Endotracheal tube, urinary catheter, and intravenous line have less risk of dislodgement in the lateral

decubitus position than the turning prone. Moreover, less labor, time, and facilities are required for lateral decubitus position.

The limitations of this study are the insufficient data (complication types, rates, and operating time) and a relatively small number of cases to conduct a case-control study. Therefore, complication rates of brachial plexus compression and pressure sore at hip, elbow, and ankle areas have not yet been determined. Given the preliminary result, further investigations are necessary to elucidate the advantages and disadvantages between these two methods.

In conclusion, in patients with normal cardiopulmonary function, a simple modification of using the lateral decubitus position for posterior iliac bone grafting is simpler, quicker, and safer than the traditional prone position. This setting is just as effective, and in selected circumstances, simultaneous oral surgery is potentially practicable.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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