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Atlantoaxial transarticular screw fixation: a technique never reported from (sub-saharan) Africa?

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Abstract

Background: Atlantoaxial transarticular screw fixation is considered to be the "gold standard" for treating atlantoaxial instabilities. This challenging surgical procedure requires high skills and appropriate surgical armamentarium. Such conditions are rarely met in sub-Saharan Africa. After a thorough review of medical literature, we did not find a single report on atlantoaxial transarticular screwing from Africa. For this reason, we decided to report on a case we operated on at our institution.

Methods: We retrospectively reviewed a case of post-traumatic acute atlantoaxial rotatory fixation (AARF) associated with C5-C6 left facet joint dislocation that we managed in our hospital with posterior atlantoaxial/transarticular screw fixation and C5-C6 lateral masses plating.

Results: A 56 years old female was admitted to our service for head and cervical spine trauma following a road traffic accident. She had asymmetrical quadriplegia and urinary retention. Computed tomography (CT) scans revealed a type II atlantoaxial rotatory fixation of left atlantoaxial joint along with stage II distractive-flexion injury of left C5-C6 facet joint. Transcranial traction with Gardner-Wells tongs was performed and patient subsequently underwent surgical stabilization with modified Magerl's technique and C5-C6 lateral masses plating. Fourthy-five days after surgery, the patient was able to walk alone without any help.

Conclusions: "State-of-the art" procedures like atlantoaxial transarticular screwing are rarely performed in Sub-Saharan Africa where surgical equipment is very insufficient. But, even in these compelling conditions, such operations can be done successfully by skilled surgeons for patients' benefit.

Keywords: Atlantoaxial joint, transarticular screw fixation, rotatory fixation, atlas (C1), axis (C2), spine trauma, (Sub-Saharan) Africa

Introduction and background

Posterior transarticular screw fixation of atlanto-axial joints is considered to be "the gold standard" for treating atlantoaxial instabilities [1-6]. It was first described in 1987 by Magerl and Seemann [1]. It provides the strongest biomechanical construct with less neck stiffness. This challenging surgical procedure requires high skills and appropriate equipment for spine surgery; conditions rarely met in sub-Saharan Africa. We performed atlantoaxial transarticular screw fixationon a 56 years old female who was admitted in our institution for acute AARF due to a road traffic accident.

Case presentation

A 56 years old female patient was admitted in our service for head and cervical spine trauma after sustaining a road traffic accident. She presented with typical "cock-robin attitude", with the head tilted on left side and rotated to the opposite side. She presented with neck pain, C2 radiculalgia on the left side, motor weakness of the four limbs, and urinary retention. On neurological examination, she had asymmetrical neurological deficits of four limbs impossible to classify according to ASIA or Frankel classifications. Details of neurological examination were as follows: bilateral hypoesthesia at C6 level predominating on the left. The hypoesthesia worsened to anesthesia at T8 level. Asymmetrical motor deficit of four limbs with complete paralysis of both hands and left lower limb (muscle strength = 0) mean while muscle strength varied from 2 to 4 for the right lower limb, forearms, arms, and shoulders. On admission, a rigid cervical collar was placed, an IV line inserted, high dose corticosteroid protocol started (30 mg/kg bolus in 1 hour, then 5.4 mg/kg for

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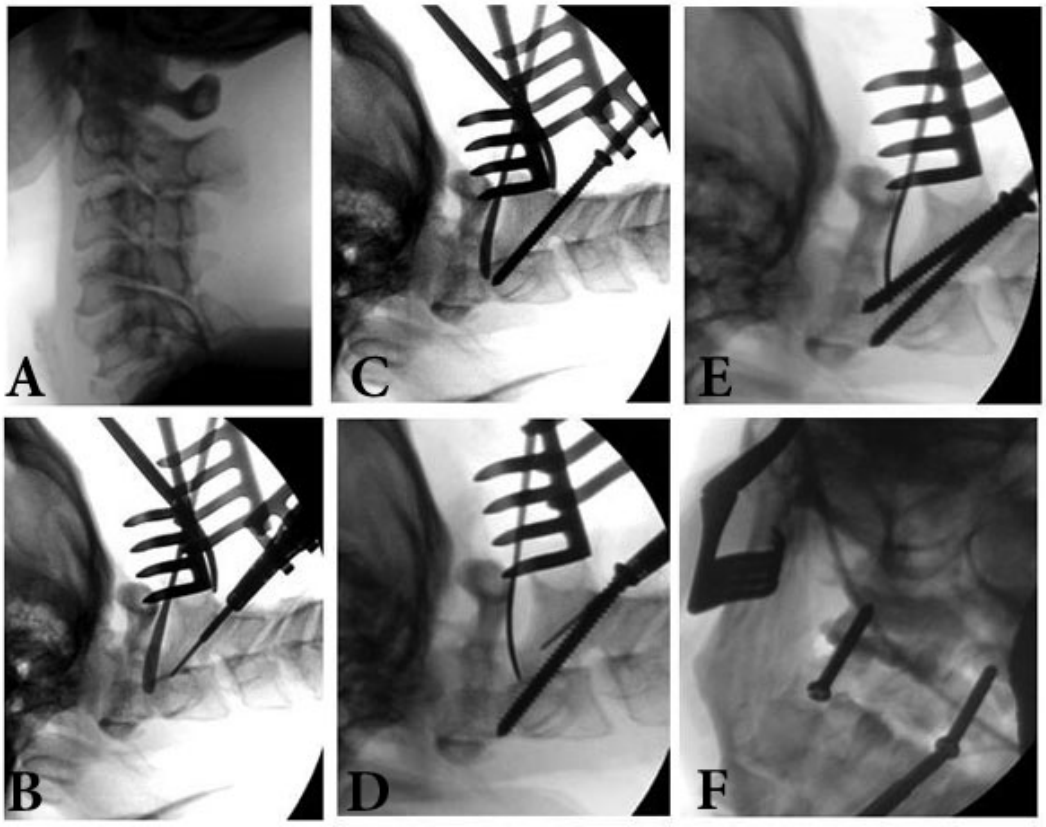

Figure 1. **A**: Pre-operatory reduction of AARF with normal atlantodens interval after transcranial traction. **B**: drilling for first screw, a Penfield dissector placed at the center of C1-C2 joint serves as a guide. **C**: partial insertion of the first screw. **D**: drilling for the second screw as in B. **E**: insertion of the second screw as in D. **F**: control of screws depth on AP view.

23 hours), along with analgesics and urinary catheter inserted. Blood samples were collected for analysis and body CT scans prescribed. CT scans of cervical spine revealed type II AARF of left C1-C2 joint and stage II DF injury of left C5-C6 facet joint along with bilateral fractures of C4, C5 and C6 laminas. Head and thoracolombar scans were without abnormalities. Transcranial traction of 1.5 kg load with Gardner-Wells tongs was done and patient underwent posterior stabilization one week later. The patient was operated under general anesthesia with endotracheal intubation. She was on prone position with the head fixed on a pinion, slightly flexed. A posterior midline incision from occiput to C7 level was made. The spinal muscles were detached subperiostly. The following structures were clearly identified: vertebral artery groove on C1, the spinal canal with spinal dura, C1-C2 joints. Both C1-C2 joints were carefully dissected. The entry point was placed just above and inside the C2-C3 joint medial boundary. Then, under fluoroscopy,drilling with a pin was made from C2 lamina towards C1-C2 joint on 45 degree angle. As a tip, we placed a Penfield dissector at the middle of C1-C2 joint to direct our drilling (**Figure 1**). Upon reaching the C1-C2 joint the Penfield dissector was removed and drilling continued towards C1 lateral mass. A 3.0 mm in diameter and 48.0 mm length screw was inserted in the same way (**Figure 1**).The position of screw was controlled on lateral and anteroposterior views. The procedure was therefore repeated on the other site (**Figure 1**). The C5-C6 facet dislocation was treated with lateral masses plating (**Figure 2**) as previously reported by the author [7]. Duration of surgery was five hours and blood loss was estimated at 600 ml. The cervical collar was removed one month after surgery and physiotherapy of four limbs continued. Patient recovery was fast and progressive. Motor function returned 45 days after surgery and the patient was able to walk alone without support from that period. Control x-rays were satisfactory (**Figure 2**). But, bladder dysfunction persisted 4 months after surgery along with burning sensations of the soles. By six months, all neurological deficits had disappeared although mild, furtive and poorly systematized burning sensations of the feet persisted. At 12 months, neurological examination was normal.

Discussion

Atlantoaxial transarticular screw fixation was first described by Magerl and Seeman [1]. It is considered to be the gold standard

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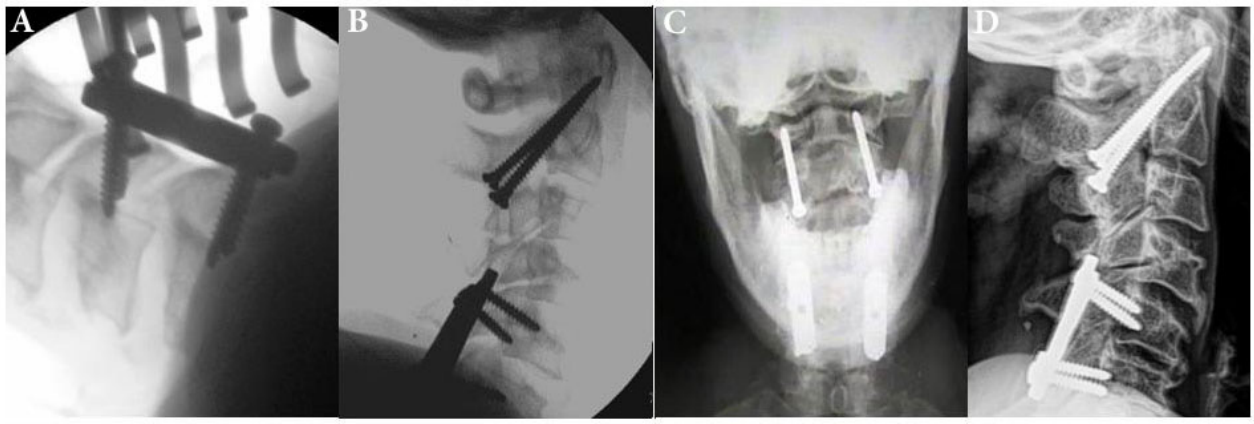

Figure 2. **A**: C5-C6 facet dislocation was treated with lateral masses plating. **B**: final per-operatory fluoroscopy, lateral view. **C**: controlx-rays at 45 days after surgery, AP view. **D**: control x-rays 12 months after surgery demonstrating arthrodesis of C1-C2 joints and between C1 posterior arch and C2 spinous process (compare with B), lateral view.

technique for treating all types of atlantoaxial instabilities [1-6]. The original technique consists in bilateral atlantoaxial transarticular screwing associated with wired autologous bone graft between C1 posterior arch and C2 spinous process. This technique was subsequently modified [2,3,8,9] and it was demonstrated that even screwing of only one atlantoaxial joint without C1-C2 wiring with bone graft is strong enough in restoring rotational stability at C1-C2 space [4,5,8]. In our case, we used the modified technique without C1-C2 wiring and grafting.

AARF treatment options are still controversial among experts because AARF is a rare condition. The optimal treatment is yet to be defined Suppress [2,6,10-14]. Goals of treatment are reduction of rotationally fixed Atlantoaxial joint, restoring stability at C1-C2, protection of nerve tissue from (further) damage, facilitating recovery.Although C1-C2 transarticular screw fixation had proven to be the best biomechanical construct, it has few disadvantages like the risk for injury of vertebral arteries, a learning curve, needs skilled surgeons, specific surgical armamentarium, and is challenging as a procedure; conditions rarely achieved in Sub-Saharan Africa. Other advantages of posterior atlantoaxial/transarticular/screwing, are that additional external contention is not necessary and it can be done even when the posterior arch of C1 is absent or fractured. Other treatment options comprise: cervical collars, halo-traction, prolonged transcranial traction, Gallie's, Sontag's and Brooks's procedures, Harms technique [2,6,11-16]. All those procedures are less efficient than C1-C2 transarticular screwing in terms of preventing further luxation of atlantoaxial joint after reduction, maintaining stability and rates of fusion. Our patients are characterized by a very bad compliance to treatment. Therefore, constraining treatments like halo traction (which is not even available in our country) are prone to very high rates of failure. For the same reason, treatments with significant rates of failure must be avoided as our patients rarely give their therapist a second chance. For these reasons, it is wise to choose the treatment with highest chances of success and the least constraint in our setting. This is why we decided as a first option to perform posterior atlantoaxial transarticular screwing. It is not useless to recall that our patient also had a stage II DF injury at C5-C6 level besides having quadriparesis with muscle strength equal to zero in many group muscles like those of both arms and left lower limb. Her C1-C2 and C5-C6 spinal lesions could be best treated at the same time by a posterior approach. It was mandatory in that case to choose the treatment with highest chances of success. Only, C1-C2 transarticular screwing and C5-C6 lateral mass plating achieved that goal for our patient. Cervical spine lateral mass plating is not in the scope of this report, but the author had previously discussed this procedure in a previous article [7].

We were very surprised as we did not find a single report related to C1-C2 transarticular fixation from Africa. We had no doubt that the procedure will be reported from northern and South Africa where quality of health care is close to that from developed countries. We found two reports from South Africa dealing with AARF or C1-C2 instabilities, but, in none of these two reports, the surgical procedure used was that of atlantoaxial transarticular screwing [15,16]. Reasons for not finding reports on C1-C2 transarticular screw fixation from Africa may be as follows: one month research on the web (MEDLINE/PubMed; electronic scientific journals; Google; Yahoo) may not have been enough to find reports cited as the last web pages were not exploited; cases operated and not reported; cases reported in languages other than western languages (arab, swahili); cases reported in journals or publications not cited in data base. On the contrary, it will not be surprising if there was really no report of C1-C2 transarticular screw fixation from Sub-Saharan Africa (excluding South Africa) because conditions for performing this procedure

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successfully are rarely met in that area. Nevertheless, to the best of our knowledge, our case could be the first reporting successful posterior atlantoaxial transarticular screw fixation from Africa.

Conclusions

Post-traumatic AARF is part of C1-C2 instabilities. It is a rare condition and its treatment remains controversial to date. Posterior atlantoaxial transarticular screw fixation technique was originally described by Magerl and Seeman in 1987. This surgical technique has proven to be the best biomechanical construct and is considered the "gold standard" for treating all types of C1-C2 instabilities. Our case may be the first reported case on this technique from Africa. In Sub-Saharan Africa where hospitals are poorly equipped, such a procedure was performed successfully in our hospital. Patients from Africa deserve the best treatment option too, therefore, it is the doctor's duty to achieve this goal.

List of abbreviations

AARF: AtlantoAxial Rotatory Fixation
ASIA: America Spine Injury Association
C1: Atlas or first cervical vertebra
C2: Axis or second cervical vertebra
C3, C4, C5, C6, C7: third, fourth, fifth, sixth & seventh cervical vertebrae respectively
CT: Computed Tomography
DF: Distractive-Flexion injury
T8: eighth thoracic vertebra

Competing interests

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We do nothave any stock holdings or shares with any organization that may have to endure the financial gain or loss after the publication, either at present or in future. We do not hold and we are not applying for any patent rights in relation to the content used in the manuscript. All expenses for this publication are supported by the corresponding author.
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Authors' contributions

Authors' contributions	AN	MLG	JCMA	BJ	ST
Research concept and design	√	--	--	--	--
Collection or assembly of data	√	√	√	√	--
Data analysis and interpretation	√	√	√	√	√
Writing of the article	√	--	--	--	--
Critical revision of the article	√	√	√	√	√
Final approval of the article	√	√	√	√	√
Statistical analysis	--	--	--	--	--

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