ISSN 2249 – 622X

Asian Journal of Biomedical and Pharmaceutical Sciences

Post-operative Delirium in Lumbar Degenerative Disease

Mustapha A. Alimi[1], Olukemi Lawani[2*]

[1]Spine Unit, National Orthopaedic Hospital, Igbobi and Cedarcrest Hospitals Lagos, Nigeria

[2]Department of Orthopaedics and Trauma, University College Hospital, Ibadan, Nigeria

Abstract

Study design: The study is a retrospective review of all patients who developed delirium following surgery for lumbar degenerative disease.

Purpose: Delirium is an acute decline in cognitive function and attention and represents acute brain failure. Post-operative alterations in attention and consciousness in Spine patients is a pathway to significant morbidity. There is a marked paucity in the literature on delirium in Spine patients in our environment. This reflects tendency to miss the diagnosis and results in avoidable morbidity and mortality. We evaluate the risk factors for delirium in surgery for lumbar degenerative disease in our environment and discuss our methods of evaluation and management.

Methods: We reviewed our cases postoperative delirium after lumbar Spine Surgery in order to elucidate the risk factors and management in our environment specifically operative stress, anaesthetic agents and pre-operative presence of psychopathology.

Overview of literature: Post- operative delirium is an acute fluctuation of consciousness following major surgery. Pathophysiology reflects imbalance in inflammatory mediators. The incidence is 3.3% in spine patients. Predisposing and precipitating risk factors include modifiable and non-modifiable conditions. Treatment hinges on knowledge of the various types, early recognition, prompt reversal of treatable causes and low- dose anti- psychotic medications

Results: There were four cases of post op delirium noted after spine stabilization for lumbar canal stenosis noted between 2014- 2016. Common factors to these cases include prolonged surgery greater than 5-6 h, the use of Pentazocine and post- operative sepsis. There were three cases noted between 2016 till date after our management protocol changed. Common factors in these later cases include prolonged surgery. The earliest symptom in all patients was an alteration of sleep pattern. Haloperidol given promptly is also beneficial in preventing the deteriorating of early symptoms into established delirium.

Conclusion: Anticipation and earlier recognition have led to prompt intervention in our more recent cases with avoidance of morbidity specifically prolonged hospital stay, wound sepsis and mortality.

Keywords: Lumbosacral Spine; Post- operative delirium; Lumbar decompression; Lumbar fusion; Anti- psychotic medication.

Accepted on December 11, 2017

Introduction

Delirium is an acute and fluctuating disturbance of consciousness with reduced inability to focus, maintain or shift attention, accompanied by change in cognition and perceptual disturbances secondary to a generalized medical disturbance [1]. Post operative delirium is that subset of delirium with a temporal association with surgery, not necessarily with anesthesia [2]. While a large part of the literature describes delirium in medical patients, especially the intensive care unit, it is an important and frequently unrecognized cause of morbidity and rarely mortality in Spine patients. There is a paucity of papers on post operative delirium in spine patients [3-6].

An incidence of 3.3% has been found in spine patients [6]. The risk factors for post-operative delirium are sub classified into predisposing factors and precipitating factors. Predisposing factors include pre-operative factors such as age >50 yr [4,6], and dementia [1,6]. Precipitating factors in the intra operative period are prolonged surgery, the use of opioids and significant blood loss/ transfusion >800 ml [6]. Post operatively development of hyponatremia [5], hypoxia [1], and the use of medications notably antihistamines, benzodiazepines, muscle relaxants, steroids have been found [1,2,4,6]. Meperidine and Diphenhydramine increase the odds of having delirium by 2.7 and 2.3 respectively while Benzodiazepines increase the odds by 3.0. Polypharmacy can also be contributory with an increased risk with the use of more than 5 medications [4].

Gao et al. compared their patients with post operative delirium and those without to elucidate the probable risk factors. The modifiable risk factors they found include severe blood loss, opioid use, comorbidities, prior central nervous disorders and low haemoglobin (less than 10mg per dl). Age greater than 65 years is a major non modifiable feature. Mean age of their patients with delirium was 68.9 years. Incidence of delirium noted was 3.3% with onset at an average of 1.2 days of post op. Mean duration was 3.1 days [1-8]. Most of them had lumbosacral Spine surgeries. Hyponatremia was noted post operatively in the delirium group but this did not achieve statistical significance. The authors attributed the increased occurrence in patients older than 65 years to the sensitivity of the aged brain to anaesthetic and non anaesthetic drugs. Less certain risk factors include low postoperative oxygen and pain which they did not study. They did not note any relationship with preoperative spine mental state [3].

Kawaguchi et al. noted an incidence of 12.5% in their patients over a three year period. Low postoperative hemoglobin was a significant finding in these patients [7].

Adogwa et al. found up to 70% percent of their elderly spinal patients had preoperative cognitive impairment and correlated this with a risk for development of postoperative delirium and higher incidence of discharge institutionalizations after discharge, while non-impaired patients were more likely to be discharged directly home. They noted preoperative cognitive dysfunction as a risk factor for post-operative development of complications such as urinary tract infection and pneumonia. These complications may however be predisposed to partly by the peculiarities of spinal deformity. The authors measured cognitive dysfunction using the Saint Louis Mental Status (SLUMS) test [8].

Pathophysiology has been found to be due to dopamine-acetylcholine imbalance [1], and inflammatory response with increases in IL-1, IL-6 and CRP noted [2].

Ushida et al. noted a high incidence of up to 30percent in their series on patients who had cervical spine surgery. Age above 70 years and high dose steroids (Methylprednisolone) were significant risk factors. They noted a relationship with hearing impairment. However their diagnosis of hearing impairment was based on bedside assessment of patient's response to conversational voice. Allowing movement as tolerated even for bed bound patients and rapid restoration of circadian rhythms helped both the prevention and treatment of delirium in their patients [9].

High post-operative pain and opioid use have been correlated with the risk of post- operative delirium in a series by Leung et al. Post operative delirium was assessed using Telephone Interview of Cognitive Dysfunction, an adapted version of the Mini mental state examination. Female sex, depressive symptoms were also identified as risk factors. The relationship between pain and opioid use was not studied [10].

The three main types are hyperactive/hypoactive/mixed [1] with the hyperactive forms comprising up to 50%. Hypoactive forms are frequently under- diagnosed and may comprise up to 25%. Evaluation hinges on clinical and laboratory tests. The Confusion Assessment Method for ICU patients (CAM- ICU) is a sensitive tool for detection of delirium validated in ICU patients and is useful even in patients on mechanical ventilation [4]. Basic laboratory tests including full blood count, electrolytes, and infection screen [5].

Treatment hinges on the correction of organic causes [5], institution of environmental and supportive measures [4] and low dose antipsychotic medications [4,5]. Some evidence from randomised controlled trials shows the effectiveness of Haloperidol compares favorably with Risperidone, Olanzapine and other atypical antipsychotics. Side effects are extrapyramidal symptoms though this only occurred with higher doses of medications more than 4.5 mg. The evidence from RCTs is however limited to a few studies compiled with overall small patient numbers thus limiting the generalizations [11].

Inouye et al. also attributed the difficulty the comparing different medications in use for efficacy and side effect profile. They concluded there is no benefit to antipsychotic medications in hypoactive forms of delirium. Benzodiazepines are also discouraged. Antipsychotic medications should be used for the shortest possible duration [4]. Physostigmine is recommended for anti-cholinergic syndrome and Ketamine is being explored for emergence/ post op delirium.

Materials and Methods

We conducted a simple observational retrospective study on our patients who developed post-operative delirium following surgery for degenerative lumbar spine disease at the authors' institutions. Their preoperative, intraoperative and postoperative records were reviewed and the risk factors for delirium classified appropriately. Descriptive measures of central tendency were used to summarize the characteristics identified. Table 1 summarizes the characteristics of patients with post-operative delirium, risk factors, treatment, and outcomes.

All patients had lumbar canal decompression with or without stabilization as indicated. One, two or three levels were operated. All patients were operated under General anaesthesia in the prone position with the airway maintained with a reinforced endotracheal tube. Routinely, preinduction medications are Dexamethasone, Tranexamic acid and Ceftriaxone. Spinal marking is done using fluoroscopic guidance and dilute adrenaline solution is infiltrated in the subcutaneous tissues and fascia. All patients were operated using a routine posterior approach to the lumbar spine. The details of diagnosis and procedure done are recorded in Table 1. Postoperatively, patients are monitored in the recovery room for the first 12-24 hours. Wound drains and urinary catheters are removed after twenty four hours and postoperative radiographs done for all patients who have had stabilization. Ambulation is started right after under the supervision of a physiotherapist with a corset for support. Wounds are reviewed on the third postoperative day and subsequently weekly.

Functional measures utilized include the Glasgow coma scale score with particular attention to the examination of orientation in time.

The data obtained was summarized using descriptive statistical methods. We obtained the following data for all our patients who had delirium after surgery for lumbar degenerative spine disease: biographical details, duration of surgery and type, preinduction medication and anesthesia. We obtained the mean duration of surgery of our patients. The time of onset of symptoms of delirium after surgery and precipitating factors. The treatment and duration of delirium were noted. The overall duration of admission were noted. All patients were routinely followed up in the outpatient departments.

Results

The results are shown in Table 1. 7 patients with post-operative delirium were noted between 2014 and now. There were 3 males and 4 females. Age ranged between 57 and 75 years. The preoperative diagnosis in all cases was spinal canal stenosis. 3 of these patients had 2-3 level lumbar decompression with stabilization. The duration of surgery ranged between 3- and 6 hours and blood loss ranged from 250-1000 ml.

Table 1: *Patients case summaries.*

Initials	Biodata and operation performed	Intra operative medications	Blood loss and transfusion	Delirium symptoms noted	Treatment given	Outcome
OA	F, 72y L4/5 decompression	Dexamethasone Fentanyl Tranexamic acid	Blood loss 250 ml	Not sleeping on 3rd day post op Calm and quiet	Haloperidol	Discharged post op day 5
AO	F, 75 yr L3- 5 laminectomy, flavectomy + stabilization	Dexamethasone Pethidine 100mg TXA 1g	Blood loss 700 ml	Difficulty sleeping for first 2 days post op	Supportive	Discharged on post op day 4
KN	M,62 yr L4/5 decompression	Propofol Suxamethonium Pentazocine Dexamethasone Halothane Isoflurane Tranexamic acid Pancuronium	Blood loss 500 ml	Aggressive and uncooperative Refusing medication 11 h post op Leukocytosis with neutrophilia from wound sepsis noted on post op day 6	Amytryptilline Olanzapine Diazepam	Delirium resolved Patient discharged home
BR	M, 64 yr L3- 5 decompression	Hydrocortisone Propofol Halothane Isoflurane Pentazocine Pancuronium Atracurium	Blood loss Massive transfusion 6 units	Urosepsis noted post op day 5	Depressive illness with psychotic features Risperidone	Discharged home
AA	F, 47 yr L4- 5 decompression and stabilization	Propofol Suxamethonium Pentazocine Halothane Neostigmine Atropine Pancuronium	Blood loss 1000 ml Transfusion 500 ml Surgery 8 h			
AA continued	Readjustment of pedicle screw	Propofol Suxamethonium Pancuronium Pentazocine	Blood loss 650 ml	Wound discharge on post op day 5 post redo surgery Restless and aggressive on post op day 7 Leukocytosis noted	Depressive illness with extrapyramidal symptoms	Haloperidol Zoloft Benzhexol Discharged home 6 weeks post op Died within one year

EG	M, 69 yr L4/5 decompression	Tranexamic acid Glycopyrollate Fentanyl Dexamethasone	Blood loss 300 ml	Difficulty sleeping on Haloperidol post op day 1 Not chatty	Discharged post op day 4

Risk factors isolated between 2014-2016 were age greater than 50 years, the use of Pentazocine intraoperatively and postoperative sepsis. We subsequently excluded Pentazocine use from our protocol and have since noted a reduction in severity of symptoms. The risk factors noted since this change in protocol are age greater 50 years, and possibly the use of Fentanyl intraoperatively. 1 patient died, within a year of discharge. 1 patient suffered long term cognitive dysfunction. There was no increase in hospital stay with early treatment. In patients with prolonged hospital stay, this was usually due to progression of conditions predisposing to delirium, or resulting from delirium such as sepsis. The commonest drug used in our patients was Haloperidol at a dose of 2.5- 5 mg daily for 3- 5 days. No side effects were noted.

Discussion

Post operative delirium is not uncommon in our environment. The earliest signs and symptoms in both the hyperactive and hypoactive forms are difficulty sleeping. Patients may be talkative or unduly quiet [1]. Natural history of delirium progresses to disruptive behavior, deliberate bed- wetting and defaecation, subsequent wound sepsis, systemic sepsis and in rare instances death.

The risk factors noted in our series parallel those noted in the literature. While we concur with Adogwa about the likelihood of a UTI as predisposing to delirium we have not found an increase in the incidence of Pneumonia in our patients. This is perhaps due to a difference in the patient population being primarily degenerative diseases and not primarily spinal deformities in their series. Between 2016 and now, we have modified our protocol to exclude the use of Pentazocine in our patients. Intraoperative analgesia is now strictly Fentanyl, with Tramadol and paracetamol in the post operative period supplemented with low dose NSAIDs. We have noted a change in risk factors identified between 2014 and now reflecting our learning curve regarding the prevention of delirium. Between 2014 and 2016, in addition to age above 50 years and prolonged surgery more than 6 hours, all the patients developing delirium had received Pentazocine in the intra operative period. Risk factors may also be additive as the only mortality was recorded in a patient in whom, in addition to the presence of all risk factors also required a repeat operation shortly after the first surgery with significant blood volume loss and transfusion. Steroids and muscle relaxants were used routinely in all our patients and we found no difference in the use of steroids and muscle relaxants between patients presenting with delirium and those who did not. We however use relatively low doses of steroids, notably 8 mg of Dexamethasone every 8 h for not more than 48 h. This is routinely administered with parental Omeprazole for ulcer prophylaxis. It is not certain yet what influences Fentanyl has on cognitive function. Between 2016 and date, operative durations have generally shortened. In addition to this a higher index of suspicion now ensures that patients are picked up at the earliest stage when alteration of sleep pattern occurs and low dose anti psychotic medications are started. Likewise aggressive attention to fluid balance, temperature control and early return to normal preoperative routine including early resumption of ambulation and oral feeds within twenty four hours ensure that the physiology of the patients are not distorted unduly. This is similar to the findings of Ushida et al though their patients had cervical spine surgery.

Postoperative packed cell volumes are checked within twenty four hours of surgery and meticulous attention to fluid balance is ensured. Postoperative full blood counts and electrolytes are no longer routine in our practice. We have found no untoward problems with his approach.

Relatives of the patients are allowed generous visiting times, and one person of the patient's choosing is allowed to stay with the patient on admission. This helps to ensure better environmental control and prevent undue discomfort from hospital admission. Culturally in our environment, greetings are based on the time of day and these also provide temporal cues which help to orient the patient in time, and prevent or correct disorientation. Disorientation in time is usually the first functional sign of disordered cognition and this is checked regularly. Return to normal sleep patterns is also crucial and low dose Haloperidol is started prophylactically in patients who are unable to achieve normal sleep in the first twenty four hours after surgery. We note that our team of Psychiatrists favor Risperidone but we have not found any demonstrable difference in the response to both medications when compared. To minimize interference, we preferentially reserve quiet rooms with the least disturbance (beyond mandatory monitoring) for these patients.

In our environment patients with delirium are erroneously confused with purely psychotic patients and this can result in undue agitation of nursing staff and patients' relatives. This affects their overall care and creates a vicious cycle which can worsen delirium. In addition to this, it can create a negative image of spine operations and discourage potential patients. In an environment where the practice of Spine Surgery is still young, it is crucial to prevent predictable deterrents.

We did not routinely use the CAM- ICU in our patients but recognize that preoperative assessments are crucial to measure baseline cognitive function in order to define the degree of cognitive dysfunction post operatively. The difficulty with this measure would include the definition of what percentage of change relative to the preoperative function should be treated

prophylactically. For this reason a high level of suspicion is probably the most important tool for early diagnosis. This is then supplemented or confirmed with the use of a scoring tool like the CAM- ICU.

Conclusion

Post operative delirium is an acute brain failure and it is not innocuous. An appreciation of risk factors and early recognition onset is crucial to prevent morbidity and possible mortality. Better harmonization in the methods of monitoring and scoring cognitive dysfunction in elderly patients for spine surgeries is required. We suggest the use of the CAM-ICU as a quick, validated scoring tool. Treatment hinges on low dose antipsychotic therapy and sedatives and early correction of organic causes. We have found low dose oral Haloperidol is adequate and safe. Proper attention to restoration of normal sleep patterns, fluid and electrolyte balance would be helpful.

References

1. Whitlock E, Vannuci A, Avidan MS. Postoperative delirium. Minerva Anestesiol. 2011; 77: 448-456.
2. Deiner S, Silverstein JH. Postoperative delirium and cognitive dysfunction. Br J Anaesth. 2009; 103: 141-146.
3. Gao R, Yang Z, Shi Z, Fu Q.
   Probable risk factors for postoperative delirium in patients undergoing spinal surgery. Eur Spine J. 2008; 17: 1531-1537.
4. American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, Inouye SK, Robinson T, Blaum C, Busby-Whitehead J, Boustani M, Chalian A, Deiner S, Fick D, Hutchison L, Johanning J, Katlic M, Kempton J, Kennedy M, Kimchi E, Ko C, Leung J, Mattison M, Mohanty S, Nana A, Needham D, Neufeld K, Richter H. Postoperative delirium in older adults: best practice statement from the American Geriatrics Society. J Am Coll Surg. 2015; 220: 136-148.
5. Robinson TN, Eiseman B. Postoperative delirium in the elderly: diagnosis and management. Clin Interv Aging. 2008; 3: 351-355.
6. Behrends M, DePalma G, Sands L, Leung J. Association between intrao-operative blood transfusion and early postoperative delirium in older adults. J Am Geriatr Soc. 2013; 61: 365-370.
7. Kawaguchi Y, Kanamori M, Isihara M, Abe Y, Nobukiyo M, Sigeta T, Hori T, Kimora T. Postoperative delirium in Spine Surgery. Spine J. 2006; 6: 164-169.
8. Adogwa O, Eisamadicy A, Lyndon E, Vuong VD, Chen's J, Karikari IO, Bagley CA. The prevalence of undiagnosed pre-surgical cognitive impairment and its post-surgical clinical impact in elederly patients undergoing surgery for adult spinal deformity. J Spine Surgery. 2017; 3: 358-363.
9. Ushida T, Yokoyama T, Kishinev Y, Hosokawa M, Tanigu hi S, Inoue S, Takemasa, Suetonius K, Aria Y-C, P, McLaughlin M, Tani T. Incidence nd risk factors of postoperative delirium in cervical spine surgery. Spine. 2009; 34: 2500-2504
10. Lonergan E, Britton AM, Luxenberg J. Antipsychotics for delirium. Cochrane Database of Systematic Reviews. 2007; CD005594.
11. Leung JM, Sands PS, Lim EL, Tsai TL, Sakura K. Does preoperative risk for delirium moderate the effects of postoperative pain and opiate use on postoperative delirium? Am J Geriatric Psychiatry. 2013; 21: 946-956.

*Correspondence to

Olukemi Lawani

Department of Orthopaedics and Trauma

University College Hospital

Ibadan, Nigeria

Tel.: + 2348023130016

E-mail: **ajanyah@gmail.com**