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Paediatric day-case neurosurgery in a resource challenged setting: Pattern and practice

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ABSTRACT

Background: It has been generally observed that children achieve better convalescence in the home environment especially if discharged same day after surgery. This is probably due to the fact that children generally tend to feel more at ease in the home environment than in the hospital setting. Only few tertiary health institutions provide routine day-case surgery for paediatric neurosurgical patients in our sub-region. **Objective:** To review the pattern and practice of paediatric neurosurgical day-cases at our hospital. **Patients and Methods:** A prospective study of all paediatric day-case neurosurgeries carried out between June 2011 and June 2014. **Results:** A total of 53 patients (34 males and 19 females) with age ranging from 2 days to 14 years were seen. Majority of the patients (77.4%) presented with congenital lesions, and the most common procedure carried out was spina bifida repair (32%) followed by ventriculoperitoneal shunt insertion (26.4%) for hydrocephalus. Sixty-eight percentage belonged to the American Society of Anesthesiologists physical status class 2, whereas the rest (32%) belonged to class 1. General anaesthesia was employed in 83% of cases. Parenteral paracetamol was used for intra-operative analgesia for most of the patients. Two patients had post-operative nausea and vomiting and were successfully managed. There was no case of emergency re-operation, unplanned admission, cancellation or mortality. **Conclusion:** Paediatric day-case neurosurgery is feasible in our environment. With careful patient selection and adequate pre-operative preparation, good outcome can be achieved.

Key words: Day-case, developing country, neurosurgery, paediatric, pattern, practice

INTRODUCTION

Day-case surgery (DCS) is a type of care that involves admitting patients for investigation or operation on a planned, non-resident basis with the provision of adequate structure for recovery in a ward or unit set aside for this purpose.[1] Interest in DCS is rapidly expanding worldwide because of reduced hospital costs, shorter waiting lists, reduced incidence of nosocomial infection, minimized psychological stress of hospitalisation and parental separation and easing of financial burden on the family.[2] However, utilisation varies among surgeons and health facilities.[3,4]

Paediatric DCS was first reported by Nicoll in 1909.[5] Over the last few decades, DCS has grown at an exponential rate, progressing from the practice of performing simple procedures on healthy outpatients to encompassing a broad spectrum of patient care in freestanding day-case centres.[6] It is estimated that nearly 90% of all elective surgery in North America is performed in the outpatient surgical setting.[6] The European Charter of Children's Rights has equally suggested that children should be admitted to hospital only if the required care cannot be well provided at home or on a day-case basis.[7]

Generally, neurosurgery makes limited use of DCS due to the nature of their surgeries.[8,9] Challenges with home

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management of post-operative complications such as nausea and vomiting, seizures, silent haemorrhage and uncertainty concerning the ability of carer to provide adequate home support for the patient in the first post-operative night are other possible reasons. Unavailability of appropriate community resources and support, and delay in the management of any new-onset neurologic deficit could also limit the use of day-case facility for paediatric neurosurgery.[10,11] Emerging reports, however, shows that craniotomy, brain biopsy and spinal decompression can be performed safely and successfully on day-case basis with the use of novel approaches such as minimal access spine surgery, endoscopic techniques, endovascular management of vascular disease and intra-operative navigation.[11,12] In Nigeria, paediatric DCS has become an established practice with some centres including ours having a dedicated day-case facility.[13,14] Although, paediatric day-case neurosurgery remains a rarity globally, it was commenced in our centre in the latter half of last decade. The aim of this study is to analyse the prospectively gathered data on our paediatric neurosurgery day-case procedures over a 3-year period with a view to appraise the pattern, the practice and the outcome of these cases.

PATIENTS AND METHODS

We prospectively studied all the paediatric neurosurgical cases operated on day-case basis from July 2011 to June 2014. Our hospital is a tertiary institution, which serves a population of about 6 million in South Western part of Nigeria. The day-case unit is within the hospital and services all the surgical subspecialties. The unit consists of four operating suites and a separate recovery area adjacent to the operating theatres. In addition, there is an examination room, treatment room and reception area. The hospital has a full-time neurosurgeon and trainees at various levels of training. The neurosurgeon sees all the paediatric neurosurgery cases in the clinic and determines their suitability for DCS.

Patients with high American Society of Anesthesiologists (ASA) status, poor anaesthetic risk (especially upper respiratory tract infection in patients requiring general anaesthesia with intubation), serious co-morbid health conditions (particularly bleeding disorders, severe anaemia, cardiovascular illness and obesity), those requiring emergency surgeries or those in which surgery is expected to be long as well as children who had no capable family member to adequately nurse at home following discharge were usually excluded from day-case procedures. An important inclusion criterion for patients scheduled for DCS is that they must have telephone access to the unit and live close to the hospital, maximum of 1 h drive to the hospital.

The patients were subsequently seen at the reception area of the day-case unit at least 2 h before surgery and compliance with pre-operative instructions ensured. There is a consultant anaesthetist coverage for the day-case unit on a daily basis. The technique of anaesthesia was either infiltrational with 1% lidocaine or general anaesthesia with inhalational induction (halothane in oxygen) and maintenance (isoflurane in oxygen/air mixture). Alternatively, intravenous induction (using thiopentone or propofol) and inhalational maintenance was performed. Adequate intra-operative analgesia was ensured. Patients were discharged home when considered home ready in the custody of their parents/guardian. Criteria for home readiness included full wakefulness, absent or minimal pain, ability to ambulate (in older children already walking) and absence of nausea and vomiting. Evaluation by the consultant neurosurgeon or a senior neurosurgery resident to ascertain home readiness was also mandatory before discharge. Parents were given appropriate instructions on prescribed post-operative medications and educated on the identification of post-operative complications. Take home analgesics were any of oral paracetamol, ibuprofen and tramadol. They were given clinic appointments for follow-up and phone numbers to call in case of any emergency. Ethical approval for the study was granted by the Ethical and Research Committee of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun State.

Data were prospectively collected using a standardized proforma. Information collected included the age and sex of patients, occupation and educational level of parents, place of residence with parents or guardians whether within the same township with the Hospital or outside, source of referral, ASA classification, anaesthetic technique used (G.A or L.A), pre-operative diagnosis, intra-operative findings and the operation/procedure performed, intra-operative and post-operative analgesia, transfers to inpatient theatre, intra-operative death, cancellations (and reasons), complications, unplanned admissions (admission overnight to closely observe any patient who had any immediate complication) or re-admission after discharge (and reasons), the duration of admission and follow-up clinic visits. Patients were classified based on age to neonates (<1 month), infants (1 month to 1 year) and older children (>1 year). The indications for surgery were grouped into traumatic, infective, congenital and neoplastic conditions. The patients were followed up at the out-patient clinic

department, initially at post-operative day 3 or 5 to review the patients, examine the wound, change dressing and note any complication. They are then given clinic appointment for subsequent visits as may be necessary. Incidence and nature of post-operative complications was also noted. Data was entered into the Microsoft® Excel, Microsoft Office Professional 2010 and data were presented as frequencies or proportions of total.

RESULTS

There were a total of 53 paediatric neurosurgical procedures [Table 1] representing 54% (53/98) of the total day-case neurosurgeries performed during the study period. Nine were performed in neonates (17%), 31 in infants (58.5%) and 13 in (24.5%) older children. During the same study period, the unit did 391 surgeries in the main operating suite out of which 125 (32%) were children. Table 2 shows the distribution of the in-patient cases. The age ranged from 2 days to 14 years. There were 34 (64.2%) males and 19 females (35.8%). Pre-anaesthetic evaluation of 33 (62.3%) patients was at the anaesthetic clinic, whereas the remaining 20 (37.7%) patients were evaluated on the morning of surgery at the day-case reception. Preoperatively, all the patients had full blood count and plasma electrolytes, urea and creatinine screening done and were found to be within normal range except 2 cases of shunt sepsis, who had mild neutrophilia. About 36% of the patients resided outside the hospital's host community (but within an hour's drive to the hospital), whereas 64.2% lived in hospital's host community.

Majority of the patients (77.4%) presented with congenital lesions [Figure 1]. The most common procedure was excision and repair of spina bifida (32%) followed by ventriculoperitoneal (VP) shunt insertion (26.4%). Most of the patients (68%) belonged to ASA physical status class 2, whereas the rest (32%) belonged to class 1. General anaesthesia was used for 83% of cases, and the remaining 17% were done under local anaesthetic technique. Local anaesthesia was used only in older children (three of these were 12 years old, one was 13 years old and two were 14 years old). Forty-seven (88%) of the patients had parenteral paracetamol for intra-operative analgesia, whereas 4 (8%) had tramadol and 2 (4%) had fentanyl. Take-home analgesic was paracetamol in 88% [Figure 2] given for a maximum of 3 days.

Three infants presented an hour after breastfeeding but were done after a delay of 4 h rather than cancelling the procedure. None of the patients

Table 1: Clinical diagnosis and procedure performed as day-cases

Diagnosis	Procedure performed	Frequency (%)
Spina bifida	Excision and repair	17 (32)
Hydrocephalus	VP shunt	14 (26.4)
Depressed skull fracture	Elevation of depressed skull fracture	3 (5.6)
Chronic subdural haematoma	Burr hole drainage	2 (3.8)
Obstructive hydrocephalus secondary to brain tumour	VP shunt	2 (3.8)
Frontal fibrous dysplasia	Excisional biopsy	2 (3.8)
Occipital encephalocele	Excision and repair	2 (3.8)
Scalp keloidal lesion	Excisional biopsy	2 (3.8)
Shunt malfunction	VP shunt revision/ removal	2 (3.8)
Shunt sepsis	VP shunt removal	2 (3.8)
Subgaleal inclusion dermoid cyst	Excisional biopsy	2 (3.8)
Skull osteoma	Excisional biopsy	2 (3.8)
Muscular dystrophy	Muscle biopsy	1 (1.8)
Total		53 (100)

VP: Ventriculoperitoneal

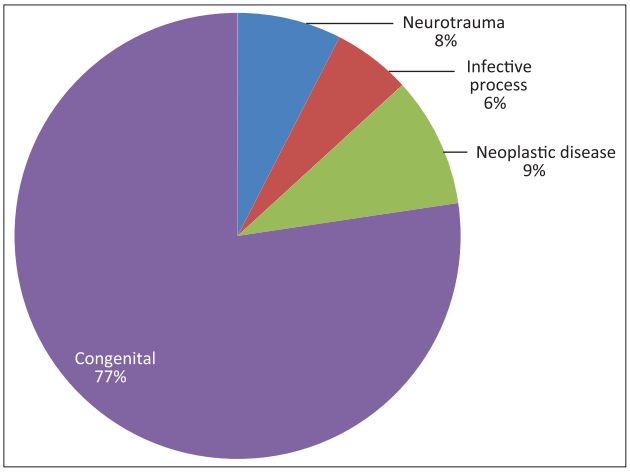

Figure 1: Pathological diagnosis

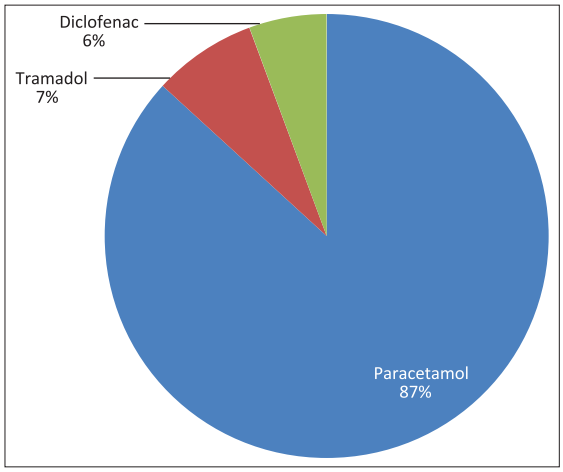

Figure 2: Post-operative analgesic prescribed

had unplanned admission [Table 3], and the only peri-operative complication following surgery been post-operative nausea and vomiting (PONV) in 2 infants. These were treated with intravenous fluid and metoclopramide at a single dose of 0.2 mg/kg and the symptoms resolved before they were discharged home.

All the patients attended and were seen at the follow-up out-patient clinic at least thrice or until the stitches were removed in older children. Vicryl, an absorbable suture was used in younger ones to avoid the inconvenience or visit to the hospital to remove the sutures. Twelve patients (23%) did not present for follow-up after 6 weeks, but none of these include the infants who had VP shunt insertion. The longest follow-up duration was 2 years. Four complications were noted in the series. A shunt malfunction (distal obstruction) was noted. The patient was readmitted and the shunt revised. Another patient was admitted with fever with the possibility of shunt sepsis, but the fever was found to be due to malaria and was treated accordingly. Two patients had superficial wound infections (one spina bifida and one depressed skull fracture) and were managed conservatively with antibiotics and wound dressing without the need for readmission.

Table 2: Paediatric neurosurgical cases done during the study period as in-patients

Diagnosis	Procedure	Frequency (%)
Hydrocephalus	VP shunt insertion	38 (30.4)
Spina bifida	Excision and repair	24 (19.2)
Encephalocele	Excision and repair	4 (3.2)
Brain tumours	Tumour excision	16 (12.8)
Scalp/skull tumour masses	Excision	3 (2.4)
Head injury with intracranial bleed	Craniotomy + clot evacuation	13 (10.4)
Open depressed skull fractures	Debridement, elevation ± duroplasty	12 (9.6)
Raised ICP	Ventriculostomy	7 (5.6)
Spinal injury	Open reduction + wiring	2 (1.6)
Intraspinal lipoma	Laminectomy + excision	1 (0.8)
Craniosynostosis	Wide linear craniectomy	3 (2.4)
Syringomyelia	Posterior fossa decompression + shunting	2 (1.6)
Total		125 (100)

VP: Ventriculoperitoneal

Table 3: Duration of hospital stay

Duration	Frequency (%)
<4 h	3 (5.6)
4-8 h	50 (94.4)
24 h/overnight stay	0
Total	53 (100)

DISCUSSION

Despite the numerous challenges confronting healthcare delivery in the developing nations, day-case paediatric neurosurgery is evolving in our facility. Many paediatric neurosurgeons may not operate myelomeningoceles and hydrocephalus as day-cases because of possible neurological deterioration and frequent re-admission from detected complications.[12,15] This may necessitate close observation of at least 6 h post-operatively. The spectrum of cases operated is limited due to our stringent inclusion criteria but not affected by rare and expensive technologies lacking in developing countries. These cases reflect the commonly managed paediatric neurosurgical conditions in our practice. Abebe *et al*.[16] in an audit of neurosurgical procedures in two major neurosurgical centres in Addis Ababa, Ethiopia, reported hydrocephalus (35.5%), neural tube defects (27.5%) and neurotrauma (9.7%) as the most common diagnoses among their paediatric patients. VP shunting (32.2%), repair of neural tube defects (27.5%) and endoscopic third ventriculostomy (ETV) (16%) were noted to be the most common procedures performed. Excision and repair of spina bifida is the most common day-case paediatric neurosurgical procedure performed in our facility followed by VP shunt insertion. ETV facilities are presently not available in our hospital; however, a relatively high incidence of shunt-related complications drives and strengthens the advocacy for shift towards ETV.[17]

Forty patients (75%) were neonates and infants, and the most common lesion was congenital disorders (77%). Other lesions were neoplastic, traumatic and infective constituting 23%. Neurovascular lesions are rare in our practice and are not routinely diagnosed in resource challenged setting like ours probably due to lack of appropriate facilities and skilled personnel.[16] We did not operate any vascular lesion as a day-case procedure though some centres may operate such on day-case basis. Goettel *et al*.[18] demonstrated that surgical clipping of unruptured cerebral aneurysms could be performed on day-case basis without compromising patient safety or quality of care. It is also noteworthy that there are reports of safe and effective ambulatory image-guided brain biopsy and ambulatory craniotomy for tumour resection in selected children and adults.[11] These are advanced neurosurgical procedures and the technologies, resources and skills driving these procedures are currently lacking in most poor resourced settings including ours.

Basic pre-operative work up for all the patients included full blood count, plasma electrolytes, urea and

creatinine and pre-operative pre-anaesthetic evaluation. To ensure a satisfactory outcome, patient selection is carefully done. Our neurosurgical patients often have the advanced disease due to delayed presentation, a common problem in developing nations. However, only children with ASA physical status one and two were selected for ambulatory surgery. The ineffectiveness, inefficiency and failure of day-case neurosurgery practice mostly result from unnecessary peri-operative delays as observed in one study.[19] This was commonly due to patient's late arrival from home, slow registration of patients in the admissions department, as well as anaesthetist's late arrival to check and review the patient in the holding area. To avoid these factors, we select patients living close to the hospital, register and keep their records for the day of surgery and usually inform the anaesthetists ahead of time. In addition, to prevent prolonged fasting especially for the infants, we administer intravenous fluid as soon as they present for surgery.

Peri-operative complications in this series were PONV seen in 2 (3.8%) patients. This rate compares favourably with the incidence of PONV among paediatric surgical patients reported by other authors in the sub-region.[20] A common complication of shunt procedures with significant morbidity and/or mortality is infection with infection rate ranging from 2% to 27%. There is a concern for DCS practice to heighten this problem; however, to our surprise, this is not so, in fact the infection rate is less than in patients done as in-patients. We have no ready explanation for this but a major contributing factor may be that since there is no dedicated ward for neurosurgical cases, and all surgical patients are managed in the same ward no matter what their disease condition may be the day-case patients benefited by having minimal contact with the hospital environment as well as no or minimal exposure to other patients.

Understandably, most patients (89%) were done under general anaesthesia due to the age of some of the patients and the nature of surgery. In addition, non-opioid analgesic (paracetamol) was the main intra-operative analgesia used in the majority (88%) of the patients. This is in line with ambulatory anaesthetic practice in order to avoid opioid-related side effects such as excessive sedation, nausea and vomiting and delayed discharge. Most of our patients (95%) were home ready and discharged within 4-8 h after surgery. The absence of unplanned hospital admission and mortality recorded in this series may be related to the strict patient selection process to ensure that only low-risk patients were selected and managed on day-case basis.

Losing 23% (12 patients) eventually to follow-up is a major set-back in this study. This is a common problem in our environment since most of our patients seek medical care only when there are problems. Many times, it is also very difficult to trace patients as many intentionally give false and untraceable residential address and wrong telephone contacts. This has made home visits virtually impossible in our practice setting.

CONCLUSION

Paediatric day-case neurosurgery is evolving and can be safely practised in our environment. The bulk of our paediatric ambulatory neurosurgical cases are VP shunt insertion and spina bifida repair, and most of our patients are neonates and infants presenting with congenital lesions. With careful patient selection and adequate pre-operative preparation, good outcome can be achieved.

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Conflicts of interest
There are no conflicts of interest.

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