Elshirbiny *et al.*
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RESEARCH

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Migration complications of lumboperitoneal shunts

Mohammad Fekry Elshirbiny*, Hatem Badr, Assem ahmed, Samer serag and Amr farid Khalil

Abstract

Background: Lumboperitoneal (LP) shunts have been described as a safe and effective option for idiopathic intracranial hypertension (IIH). However, it had many complications, including migration. Herein, we report our experience regarding the incidence, different sites, presentation, and management of LP shunt migration in patients with IIH.

Patients and methods: This retrospective series reviewed the data of IIH patients who had migration after LP shunt during the period between January 2018 and June 2021.

Results: From 67 patients who had LP shunt, 12 patients developed shunt migration. Two cases had intrathecal migration, while three cases had intraperitoneal migration. In four cases, the distal tube migrated to the subcutaneous location at the abdomen, whereas the other two cases had the proximal tube migrated outside the thecal sac to the subcutaneous location in the back. In one case, the distal tube migrated from the abdomen to the back subcutaneously.

Conclusion: The insertion of LP shunts appears to be a relatively safe technique. Shunt migration, on the other hand, is a common side effect. While various theories have been proposed to explain shunt migration, good shunt fixation remains the most critical component in preventing shunt migration.

Keywords: Lumboperitoneal shunt, Migration, Idiopathic intracranial hypertension

Background

Idiopathic intracranial hypertension (IIH) or pseudotumor cerebri is a clinical entity used to describe patients with manifestations of increased intracranial pressure (headache, papilledema, and loss of vision) in the absence of any apparent cause of such pressure rise on neuroimaging or other diagnostic evaluations [1]. This condition commonly affects obese women aged between 20 and 44 years [2, 3].

Multiple medical and surgical management options are present to control IIH. Usually, medical treatment is commenced at first, and surgery is reserved for patients with visual impairment at the first presentation or after the failure of medical treatment [4]. Surgical options rely mainly on the diversion of cerebrospinal fluid via either lumboperitoneal shunt (LP shunt), ventriculoperitoneal shunt (VP shunt), or optic nerve sheath fenestration [5].

LP shunt represents about 40% of total CSF shunting procedures [6]. It is preferred by many neurosurgeons as it is a completely extracranial procedure [7–9]. Nevertheless, it had multiple complications, including obstruction, migration, over-drainage, mechanical failure, fracture, infections, and intraabdominal complications [10, 11].

Most neurosurgeons recommend fixing the shunt catheter in place with the tabs provided with the catheter to decrease the risk of that complication [12]. Inadequate fixation of the shunt will lead to proximal or distal migration, which in turn will interfere with CSF drainage [13]. Migration could occur proximally to the spinal canal or the cranial cavity, whereas distal migration could occur to the peritoneal cavity [6, 14].

Herein, we report our experience regarding the incidence, different sites, presentation, and management of LP shunt migration in patients with IIH.

*Correspondence: mohammad.fekry@mans.edu.eg

Faculty of Medicine, Mansoura University, Mansoura, Egypt

Patients and methods

This retrospective series was designed for cases who underwent LP shunts for idiopathic intracranial hypertension at the Neurosurgery Department of Mansoura University during the period between January 2018 and June 2021. We included patients who had migration complications of LP shunts. However, patients who underwent other shunt types, who had LP shunts for other indications rather than IIH, had any other complications rather than migration, or were lost at follow-up were excluded.

Before the procedure, all patients were subjected to history taking, full neurological examination, and routine preoperative investigations, including fundus examination. Brain computed tomography (CT) or magnetic resonance imaging (MRI) plus MR venography (MRV) were ordered for all patients to exclude any intracranial pathology, and spinal manometry was also done to confirm the increased CSF pressure. All patients have reported failure of the medical treatment options before being scheduled for the operation. We also obtained informed written consent from all patients before the procedure, after explaining its benefits and possible complications. The previous steps are routinely performed for all IIH patients before the surgical procedure.

The LP shunt was performed according to the procedure described by El-Saadany et al. [5]. We used three sutures to fix the catheter in place, two at the lumbar fascia and one at the abdominal wall fascia. All patients received the same standard postoperative care after the procedure. Regular follow-up visits were scheduled for all of them after discharge. During these visits, clinical and radiological evaluations were performed.

Shunt migration was suspected when the patient experienced a recurrence of his/her symptoms, and it was confirmed by a lumbar X-ray. Then, a CT examination of the spinal canal was done to confirm the site of the catheter's proximal tip. The management option was decided according to the place of the catheter and patient symptoms.

The data of the twelve cases were presented in the following table (No. 1). Numerical data were expressed as range (and mean).

Results

During the previously mentioned time period, 67 patients underwent LP shunt, of whom 12 patients had migration complications (17.91%). Their ages ranged between 22 and 46 years (mean = 34 years). Most of them were women (11 patients—91.67%), while the remaining case was a man. The duration of the original operation ranged between 60 and 95 min, whereas migration was detected after the primary procedure by one to twelve months (mean = 3.67 months).

The 12 patients who experienced shunt migration were as follows (Table 1 and Fig. 1):

- Two had intrathecal migration. One case was complicated by granuloma and presented with paraparesis that resolved with shunt removal. The other case was conservatively managed, and the patient was advised to lose weight to manage his symptoms.
- In three cases, the shunt totally migrated intraperitoneally and was retrieved later on with laparoscopy. A new shunt was inserted for these cases for managing their IIH symptoms.
- In four cases, the distal tube migrated to the subcutaneous location at the abdomen. They were managed via revision and reinsertion.
- In two cases, the proximal tube migrated outside the thecal sac to the subcutaneous location in the back. Both were managed by revision and reinsertion.
- In only one case, the distal tube migrated from the abdomen to the subcutaneous tissue of the back. The old shunt was removed, and a new one was inserted.

Discussion

This case series was conducted to present our experience regarding the incidence, different sites, presentation, and management of LP shunt migration in patients with IIH. Our findings showed that 12 patients out of the 67 patients who underwent LP shunt during the study period developed shunt migration (incidence = 17.91%). Another study reported a 14% migration rate for the same shunt type [15], which is near to our finding. Another Egyptian study reported a higher migration rate, which was encountered in 30% of the included sample [16].

In our series, only two patients out of the included 12 patients with shunt migration, whereas the remaining patients were diagnosed with distal migration. The current literature agrees with our findings as distal migration is more common compared to the proximal one that is not extensively discussed [12, 17].

Our findings showed that two patients had proximal intrathecal migration, and one of them had paraparesis that was successfully resolved after shunt removal, while the other one was conservatively managed (Figs. 2, 3, 4, 5, 6, 7 and 8).

Proximal shunt migration could be caused by improper fixation of the shunt catheter, increased intra-abdominal pressure, and CSF pressure changes with respiration [12, 18, 19]. Moreover, the bulk flow of the CSF toward the abdominal cavity may drive the shunt to a new position. Furthermore, the placement of the

Table 1 Clinical data of the included 12 patients with migrated LP shunt

No	Age	Gender	Date of the primary procedure	Presentation at migration	Time of migration	Type of migration	Method of diagnosis	Management
1	28	F	Jan 2018	Recurrence of IIH symptoms	3 months	Intraperitoneal	Xray + Fundoscopy	Laparoscopic retrieval + new shunt insertion
2	33	F	April 2018	Abdominal wall swelling	1 month	Subcutaneous at the abdomen	Xray + Fundoscopy	Revision + reinsertion
3	46	F	June 2018	Paraparesis	1 year	Intrathecal granuloma	Dorsal MRI	Excision of the granuloma
4	24	F	Dec 2018	Recurrence of IIH symptoms	2 months	Proximal end at the back subcutaneous	Xray + Fundoscopy + CT scan	Revision + reinsertion
5	42	F	Feb 2019	Abdominal wall swelling	1 month	Subcutaneous at the abdomen	Xray + Fundoscopy	Revision + reinsertion
6	38	F	March 2019	Recurrence of IIH symptoms	5 months	Intraperitoneal	Xray + Fundoscopy	Laparoscopic retrieval + new shunt insertion
7	41	F	May 2019	Asymptomatic	4 months	Intrathecal ascend	Xray + Fundoscopy + CT scan	Follow up + advice for weight reduction
8	35	F	Nov 2019	Back swelling	6 months	Shunt at the back subcutaneous	Xray + Fundoscopy + CT scan	Removal + new shunt insertion
9	29	F	Feb 2020	Recurrence of IIH symptoms	3 months	Proximal end at the back subcutaneous	Xray + Fundoscopy + CT scan	Revision + reinsertion
10	40	M	Aug 2020	Abdominal wall swelling	4 months	Subcutaneous at the abdomen	Xray + Fundoscopy	Revision + reinsertion
11	22	F	Jan 2021	Abdominal wall swelling	1 month	Subcutaneous at the abdomen	Xray + Fundoscopy	Revision + reinsertion
12	30	F	April 2021	Recurrence of IIH symptoms	2 months	Intraperitoneal	Xray + Fundoscopy	Laparoscopic retrieval + new shunt insertion

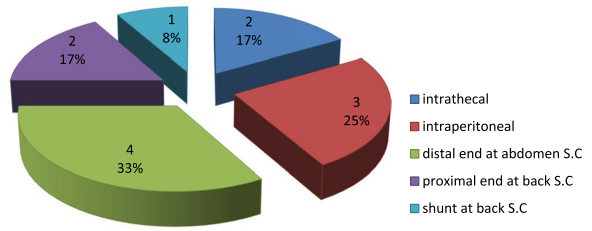

Fig. 1 Pie chart showing the site of migration in the selected participants

intrathecal end of the catheter in the rostral direction rather than the caudal one could also explain the proximal migration phenomenon [18].

Other researchers attributed proximal migration to lumbar spine rotational and lateral movements as well as flexion and extension of the head and neck. These movements can cause slow but steady upward migration of the catheter tube [20]. Insertion of a one-piece chamber or no-reservoir shunts may also contribute to the migration complication [18, 21].

A previous Egyptian case report discussed the proximal migration of such LP shunt in a 16-year-old girl diagnosed with IIH. Four months after the primary procedure, she experienced low back pain and headache. On performing a CT scan, the proximal catheter tip was present in the frontal horn of the lateral ventricle. The patient refused to perform surgery after explaining its risks, and she reported marked improvement of her symptoms with carbamazepine, diuretics, and steroids, although she did not report improvement for these medications before surgery. The authors did not find an explanation for such a finding [6].

Carroll and Jakubowski reported complete intrathecal migration of LP shunt three years after the primary operation. The patient was complaining of recurrent headaches, and migration was discovered after a lumbar spine CT examination. The shunt was removed through L4 laminectomy and opening of the dura [19].

Gezer and his colleagues reported a case of proximal shut migration into the cerebello medullary cisterns one month after the LP shunt procedure for IIH. The patient was complaining of neck pain, and CT examination revealed a catheter tip at the cistern. Reoperation was scheduled, and the proximal catheter tip was pulled down to the L-1 level under C-arm guidance. The shunt was then fixated to the subcutaneous tissue using non-absorbable sutures [22].

Other authors reported migration of the LP shunt to the prepontine and ambiens cisterns after its insertion for post-traumatic hydrocephalus. The patient was

Fig. 2 (Case 3) Sagittal T1-weighted magnetic resonance image after contrast administration.enhancing tissue is seen encircling the catheter

managed by a VP shunt, and the old shunt was left in place, as the proximal placement of the shunt did not cause any manifestations, and its removal was too risky for the surrounding brain stem structures [14].

Based on the previously mentioned studies regarding proximal migration, one could see that the catheter may migrate into either the thecal sac or the cranial cavity, with varying presentations. Also, the method of management would differ according to the presentation, site of migration, and surgeon experience.

In the current series, distal shunt migration was detected in ten patients (three of them had intraperitoneal migration, while the remaining seven cases had subcutaneous migration).

Multiple theories have been proposed to explain distal shunt migration. Bowel movements could enhance intraabdominal migration. In addition, subcutaneous migration could be elicited by increased intraabdominal pressure pushing the catheter outwards. Loose subcutaneous tissue resulting from much dissection, increased amount of subcutaneous fat in obese patients, and abdominal wall movements could explain subcutaneous migration as well [23].

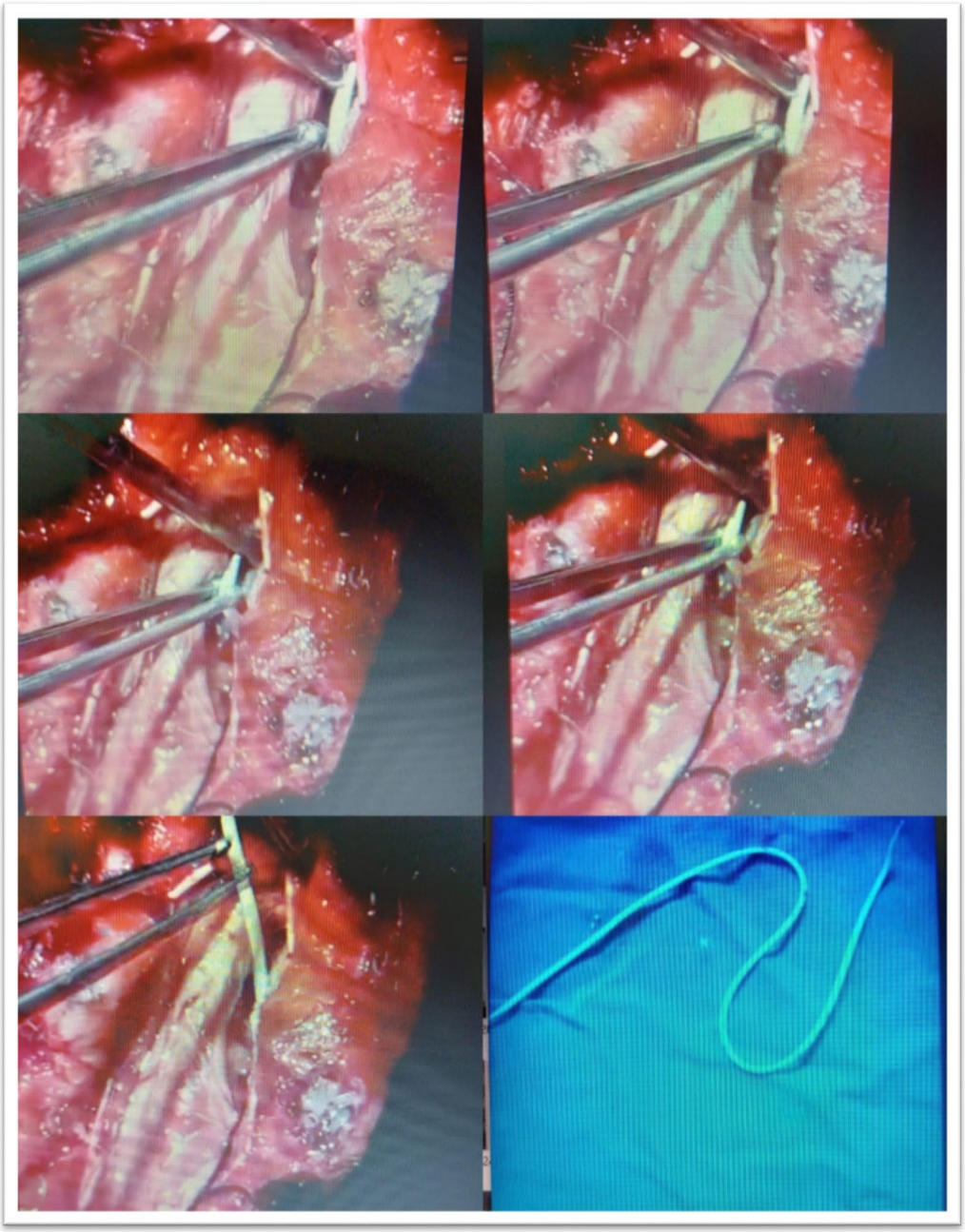

Fig. 3 (Case 3) Intraoperative photographs during extraction of the tube frome inside the thecal sac

Jivko reported retroperitoneal migration of the distal catheter in a patient with an LP shunt. This was followed by transgluteal extrusion. The catheter passed from the retroperitoneum to the hypodermal area after passing through the greater sciatic foramen and the gluteal muscles. The author concluded that catheter-related complications like migration and hollow organ injuries still occur despite the great advances in catheter material, including flexible silicon materials [24].

Kimura and his associates reported a scrotal migration of LP shunt in a 57-year-old man after he had developed a frontoparietal CSF collection following resection of recurrent parasagittal meningioma. One month after the operation, the patient presented with recurrent CSF collection along with a right scrotal

Fig. 4 (Case 7) CT scan showing Intrathecal migration of proximal tube inside the thecal sac

swelling. Radiological investigation showed the presence of the coiled catheter in the right hemiscrotum, and it was successfully extracted through a scrotal incision under local anesthesia [25].

Kawahara and his coworkers reported intrabronchial migration of the peritoneal catheter of the LP shunt inserted in a 71-year-old man for idiopathic normal pressure hydrocephalus. One year following shunt insertion, the patient complained of fever and productive cough. Radiographic examination revealed the presence of the distal end of the shunt in the left main bronchus. The authors explained that finding by the formation of a local inflammatory reaction or fibrosis around the peritoneal catheter, induced by the pressure on the diaphragm, might finally cause perforation of the wall. The catheter was extracted through the abdominal

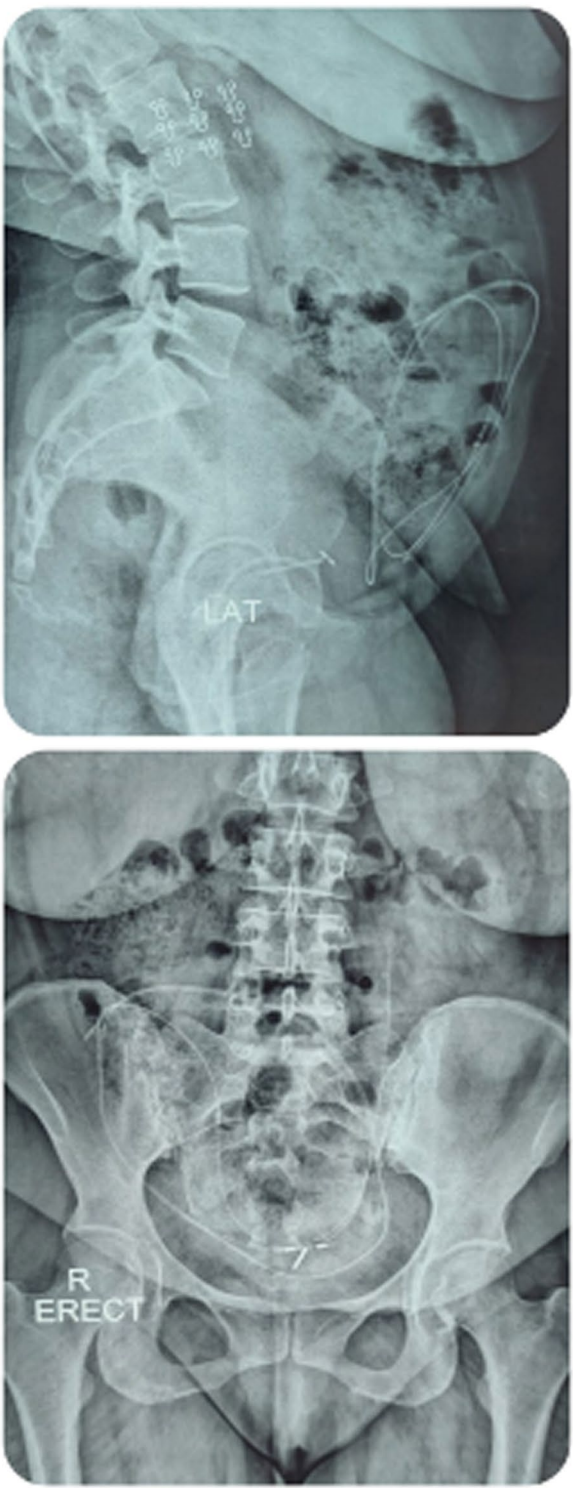

Fig. 5 (Case 6) Xray lat an AP views showing total migration of the shunt inside the peritoneal cavity

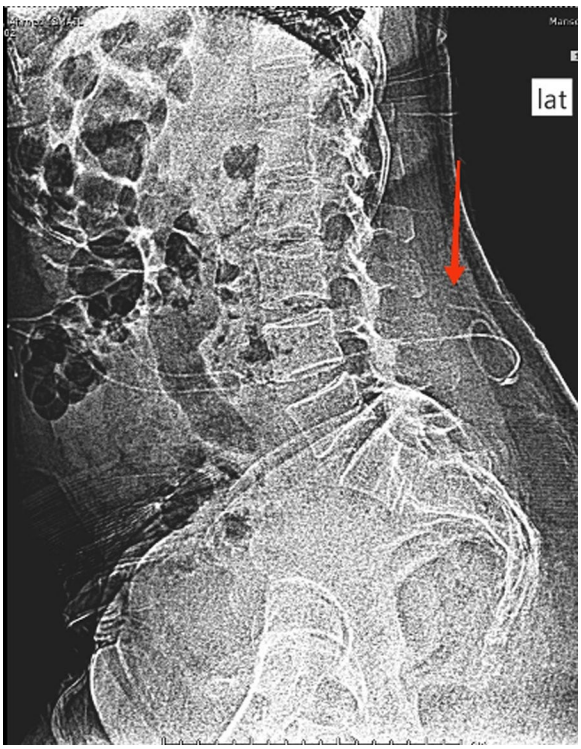

Fig. 6 (Case 9) Xray showing migration of the proximal tube outside the thecal sac

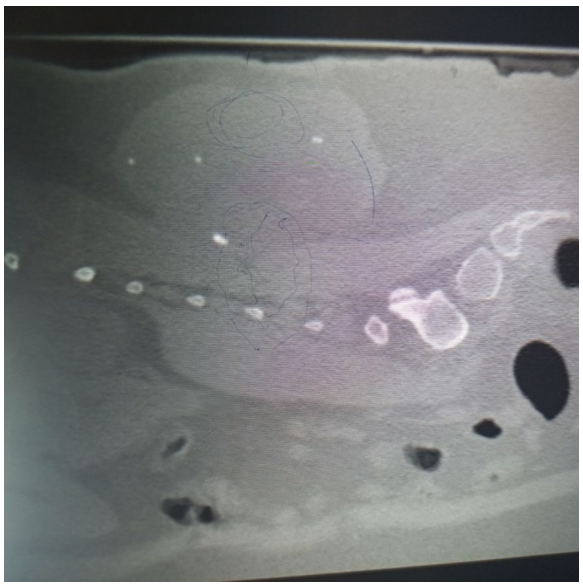

Fig. 7 (Case 8) CT shows migrated shunt from abdomen to the back subcutaneously

Fig. 8 (Case 8) Xray shows migrated shunt from abdomen to the back subcutaneously

wound under both fluoroscopic and bronchoscopic guidance. Patient symptoms were successfully managed by a VP shunt after one month [26].

It appears that there is a wide variation in the sites of distal migration of LP shunt catheters, either inside the abdomen or in the surrounding subcutaneous tissues.

The problem of LP migration should alert the neurosurgical society to develop new techniques to prevent the incidence of such a complication. Another alternative is to search for alternative management options for IIH. These alternatives should be discussed in a worldwide consensus in the near future.

Conclusions

Overall, LP shunt implantation appears to be a safe technique. Shunt migration, on the other hand, is a common complication. The type of migration whether proximal or distal could not be expected, as well as the migration site. This need to be collected in a worldwide systematic review to report all migration sites, detect its predictors, and to put a clinical algorithm to manage this complication. While various theories have been proposed to explain shunt migration, the most significant single component in preventing shunt migration is appropriate shunt fixation although raised intraabdominal pressure and strong force produced by lumbar movements unfortunately may overcome this.

Abbreviations

CSF: Cerebrospinal fluid; CT: Computed tomography; IIH: Idiopathic intracranial hypertension; LP: Lumboperitoneal; MRI: Magnetic resonance imaging; VP: Ventriculoperitoneal.

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Author contributions

Research concept and design (MFE, HB, AFK), Collection and/or assembly of data (MFE), Data analysis and interpretation (MFE, AA, SS), Writing the article (MFE, AFK, AA, SS), Critical revision of the article (MFE, HB, AFK), Final approval of article (MFE, HB, AFK). All authors read and approved the final manuscript.

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Available.

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Ethics approval and consent to participate

Done.

Consent for publication

Done.

Competing interests

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