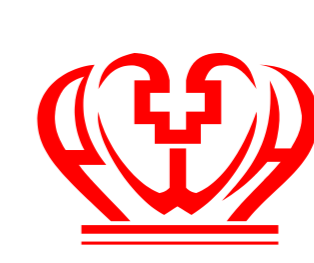
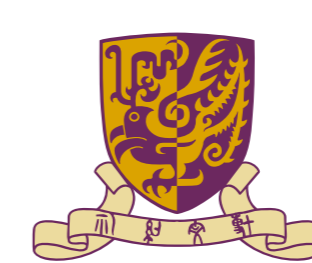


# PAEDIATRIC HAEMORRHAGIC STROKE – A CASE SERIES IN HONG KONG

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## INTRODUCTION

- Stroke is one of the top ten causes of death in children.
- Haemorrhage stroke accounts for nearly half of stroke in paediatric patients.
- There are few established guidelines to aid the diagnosis and management of paediatric haemorrhagic stroke (PHS).
- We aimed to review to delineate the aetiology of PHS and compare the outcomes of various management approaches to improve the treatment for children with PHS.

## METHODS

- A retrospective analysis of PHS patients admitted under Neurosurgery at the Prince of Wales hospital between June 1989 and May 2018.
- Case notes and imaging were reviewed to classify the presenting symptoms, type of haemorrhage, underlying aetiology, acute and long-term management of each PHS patient.
- Outcomes were evaluated based on the 30-day complication rate, rebleeding rate and functional outcome using the Modified Rankin scale.

## RESULTS

- 39 patients with PHS were identified. The mean age at presentation was 9 years (range 1 month to 18 years).
- Intracerebral haemorrhage (Figure 1) was the most common type of PHS (62%). Around 36% of PHS were complicated by either midline shift, obstructive hydrocephalus or intraventricular haemorrhage.

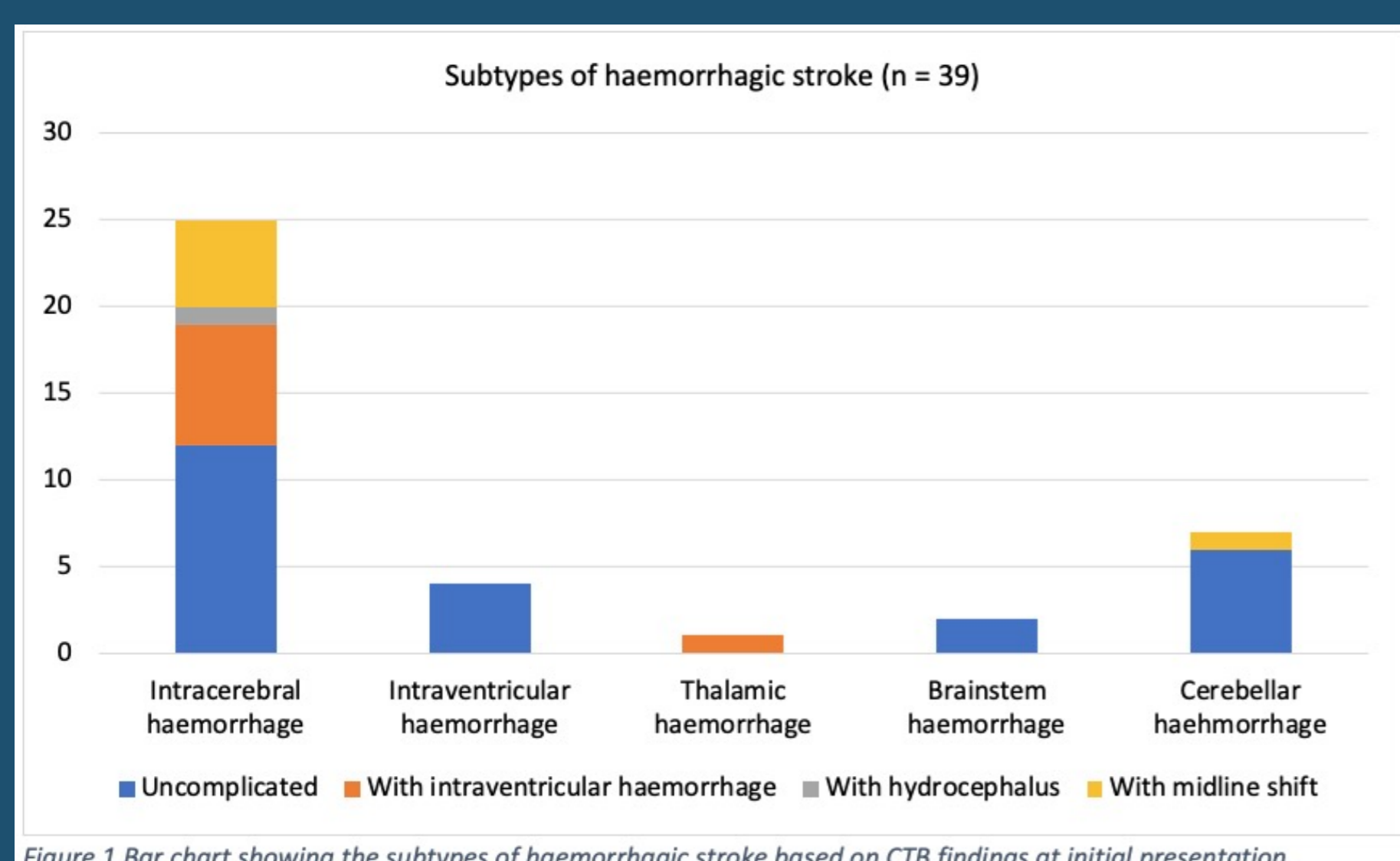


Figure 1. Bar chart showing the subtypes of haemorrhagic stroke based on CTB findings at initial presentation.

## Clinical presentation

- In younger children, the presenting symptom was often non-specific, for example, a decrease in general condition (50%). In children 6 years or older, around three quarters of PHS patients complained of headache (Figure 2).

Figure 2. This illustrates the presenting symptoms of patients with PHS at ages < 6 years and ≥ 6 years. Note that some children had more than 1 presenting symptoms.

Presenting symptom	Age < 6 years (n = 8)	No. of children (%)
Decrease in general condition	4	50
Weakness	2	25
Headache	1	13
Vomiting	1	13
Seizure	1	13
<b>Age ≥ 6 years (n = 31)</b>		
Headache	24	77
Vomiting	13	42
Weakness	4	13
Loss of consciousness	3	10
Seizure	2	6
Diplopia	2	6
Decrease in general condition	1	3

## Underlying aetiology

- Structural vascular lesions are the most common cause of PHS, with nearly half of our patients having arteriovenous malformation (AVM) and almost a quarter with cavernous malformation (Figure 3).

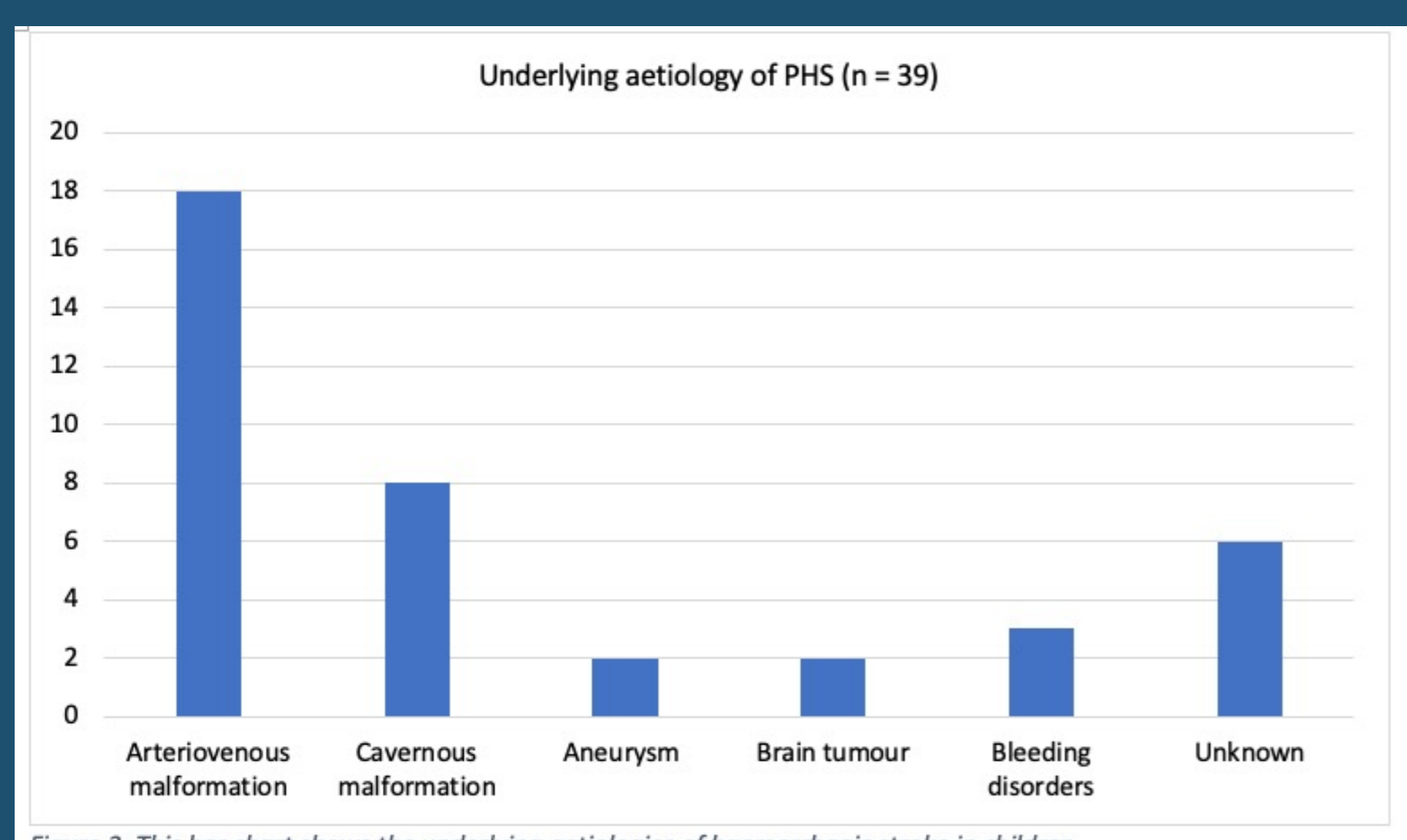


Figure 3. This bar chart shows the underlying aetiologies of haemorrhagic stroke in children

## Acute management

- 22 patients (56%) received surgical intervention upon admission (Figure 4).
- For patients with underlying AVM, most received surgical treatment. On the contrary, most patients with cavernous malformation only required conservative treatment.

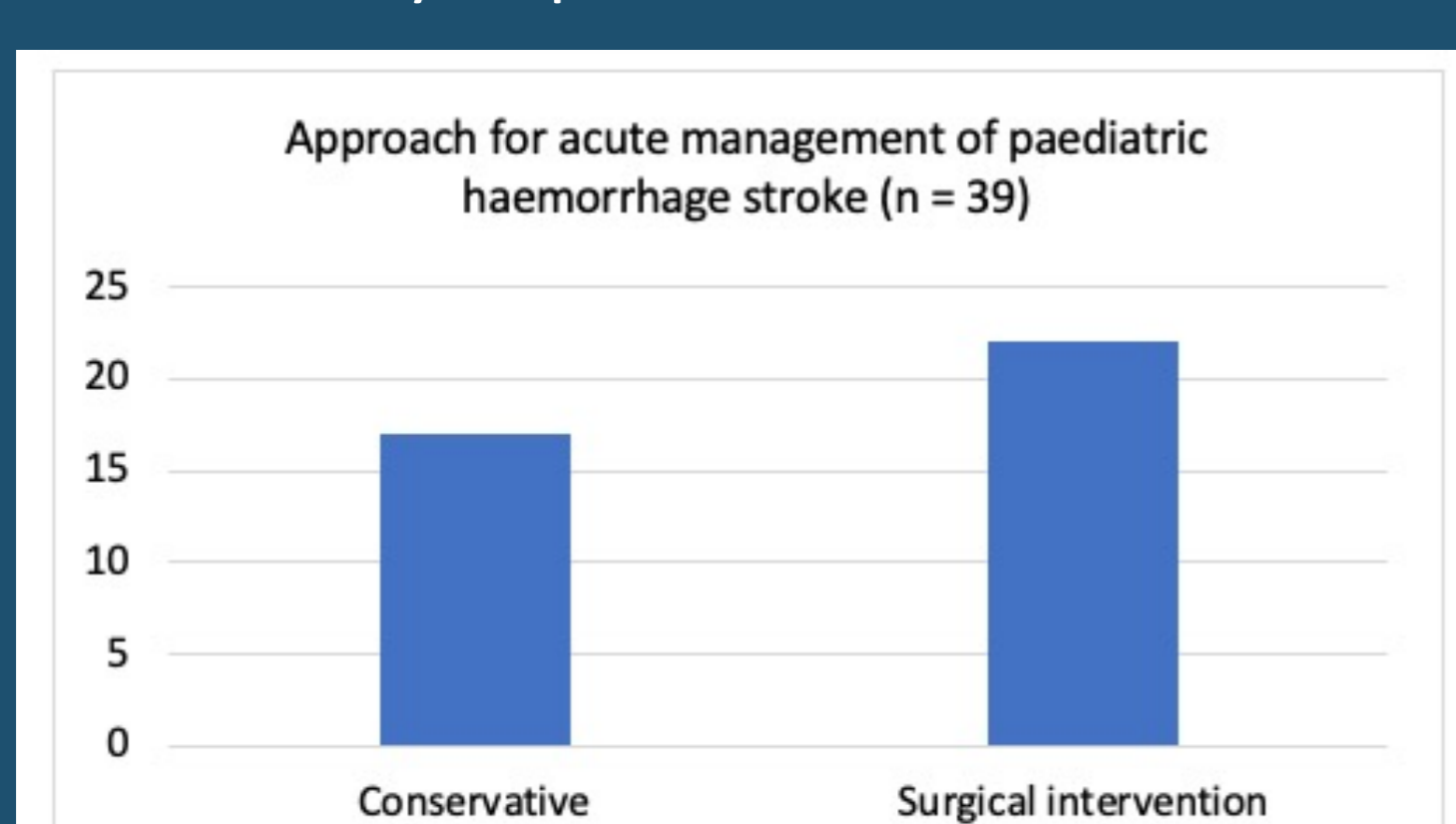


Figure 4. Bar chart demonstrating the approach for acute management of PHS.

## 30-day complication rate

- The 30-day complication rate for surgical intervention more than double that for conservative treatment (Figure 5).

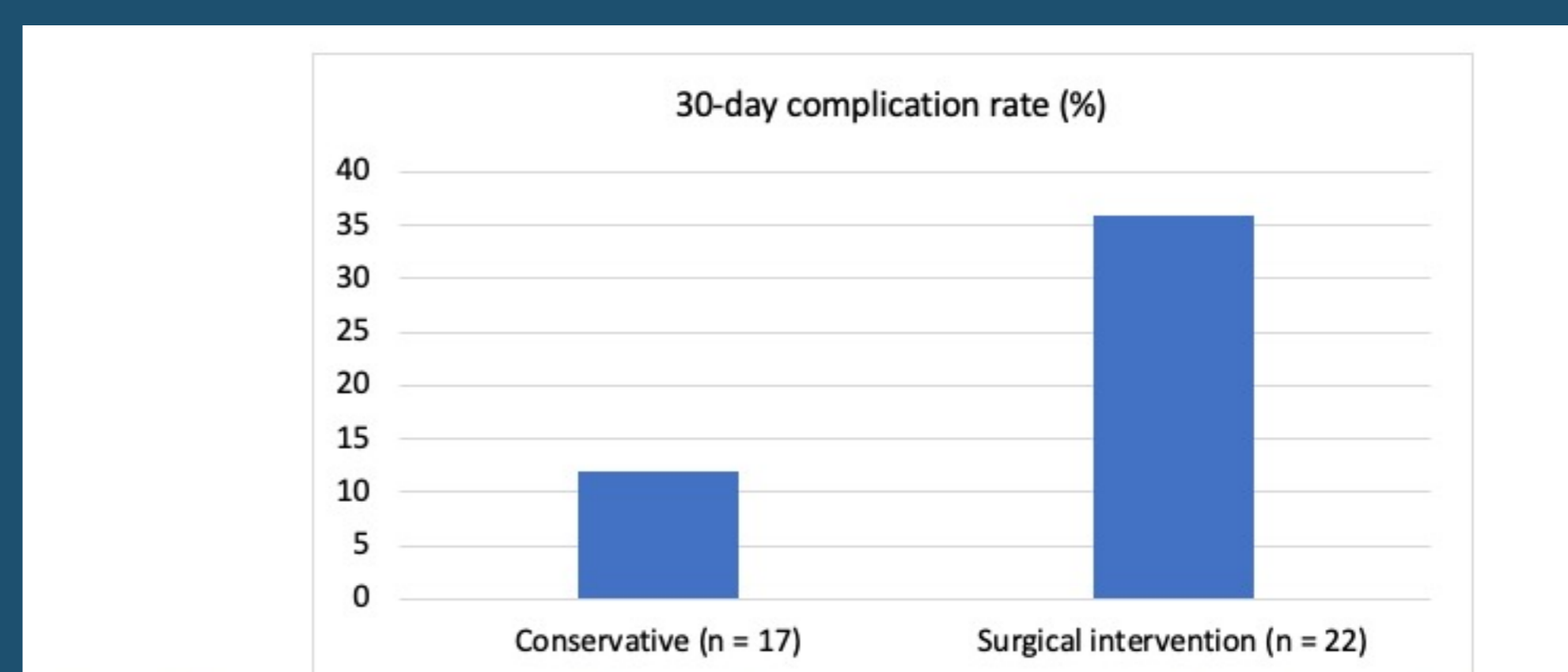


Figure 5. This bar chart compares the 30-day complication rate of conservative and surgical approach for acute management of haemorrhagic stroke in children.

## Long-term rebleeding rate

- For patients who were managed conservatively, nearly half of them required interval definitive surgery (47%) (Figure 6), with a rebleeding rate of 6%. 35% of conservatively-managed PHS patients continued with observation and the rebleeding rate was 12%.
- The rebleeding rate of those surgically-managed PHS in acute setting was zero, which was significantly lower than those who were managed conservatively.

Long term management	No. of children (%)	Rebleeding rate No. of children (%)
<b>Conservative management in acute settings (n = 17)</b>		
Continue to observe	6 (35)	2 (12)
Surgical clot evacuation	2 (12)	0
Definitive surgical treatment	8 (47)	1 (6)
Death	1 (6)	n/a
<b>Surgical management in acute settings (n = 22)</b>		
Observation	16 (73)	0
Reoperation	5 (23)	0
Death	1 (4)	n/a

Figure 6. This table compares the rebleeding rate of different long term management approaches for haemorrhagic stroke in children.

## Functional outcome

- The median Modified Rankin score was 0 (interquartile range = 1) based on the clinical condition at the most recent follow-up.

## DISCUSSION

- Structural vascular lesion accounts for most PHS. The most common cause was AVM from our data.
- The presenting symptom for PHS depends on the age of presentation. For younger children, it may be non-specific, such as general decrease in condition and lethargy, so a high level of suspicion is necessary for prompt diagnosis, especially since PHS is a common cause of death.
- The rebleeding rate for surgically-managed patient was lower than that of conservatively-managed patients, despite a higher 30-day complication rate for patients who underwent emergency surgery.
- Successful excision was often achieved. Most patients had no residual structural lesions on imaging post-operatively.
- Our data supports emergency excision of lesions in the acute settings for PHS patient. Despite this, the timing of surgery depends on the aetiology and clinical condition of patients.
- Most PHS patients have good functional recovery and were symptom-free.
- A more comprehensive study, which contains patients recruited from multiple centres across different levels of care may provide more information on the aetiological spectrum and management strategies

## CONCLUSION

- The rebleeding rate may be lower for surgically-managed PHS patients than conservatively-management patients, as most underlying lesions of PHs are vascular lesions.
- However, the timing of surgery remains controversial.

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