Neuro Imaging ORIGINAL ARTICLE

Mega Cisterna Magna: A Case Series

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ABSTRACT

This paper presents nine cases of mega cisterna magna, which could be a normal anatomical variation, not a result of a pathological process in many cases. The cases in this paper show three patterns of mega cisterna magna: bilateral, unilateral, and contained. One of these types is more dangerous because it is more associated with anatomical variations of falx cerebelli. All the patients in this case series were all male patients who were collected randomly, which contradicts the gender predilection in the literature.

KEY WORDS

Mega Cisterna Magna; Cisterna Magna; Computed Tomography; Brain Cisterns; Normal Variation; Neuroradiology.

Introduction

Mega Cisterna Magna (MCM) is a focal subarachnoid space filled with CSF in the reterocerebellar space in the posterior cranial fossa. MCM is found in 1% of post-natal brain scans and it makes up to 54% of the cystic malformation of the occipital fossa [1]. MCM is associated with infarctions, chromosomal malformations (i.e. trisomy 18), and infections (i.e. cystomegalovirus). The differntial diagnosis for MCM includes the following: posterior fossa cysts (i.e. both epidermoid and arachnoid), Dandy-Walker variant, persistent Blake's pouch cyst, and posterior fossa neoplasia (i.e. pilocystic astrosytoma) [2]. MCM has been associated with autism spectrum disorder [3, 4]. When MCM exists and there is no abnormility in the ventricles, it should be considered an anatomical variation with no prognostic significance [2]. There is no surgical intervention for MCM cases [2].

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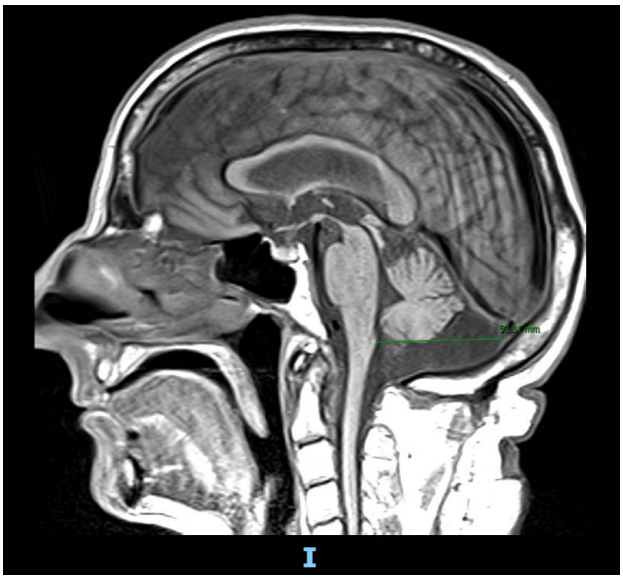

Figure 1. *A saggital MRI scan of the brain with MCM measured 50 mm from the dorsal part of the brain stem and measured 15 mm from the back of the cerebellum.*

Anatomical Relations

Cisterna magna extends anteriorly to the forman of magandi and posteriorly to an arachnoid memberane [2]. Cisterna magna is surrounded by the vermian pyriamid and tonsils superiorly and it reaches the first cervical level inferiorly [2]. The MCM is separated medially by falx cerebelli [2].

Embryology Development

The MCM devolpes from Blake's pouch premeabilization, which allows CSF to follow from the 4th ventricle superiorly through the foramen of magendie and inferiorly with peri-medullary subarachnoid spaces [5]. The MCM is formed in the 7th gestational week with the completion of the leptomininges [5]. The cisterna magna occopies the vallecula cerebelli, which is located inferiorly to the cerebellar tonsils and the inferior surface of the vermis [5].

Measurements

An enlarged cisterna magna measured >10 mm on

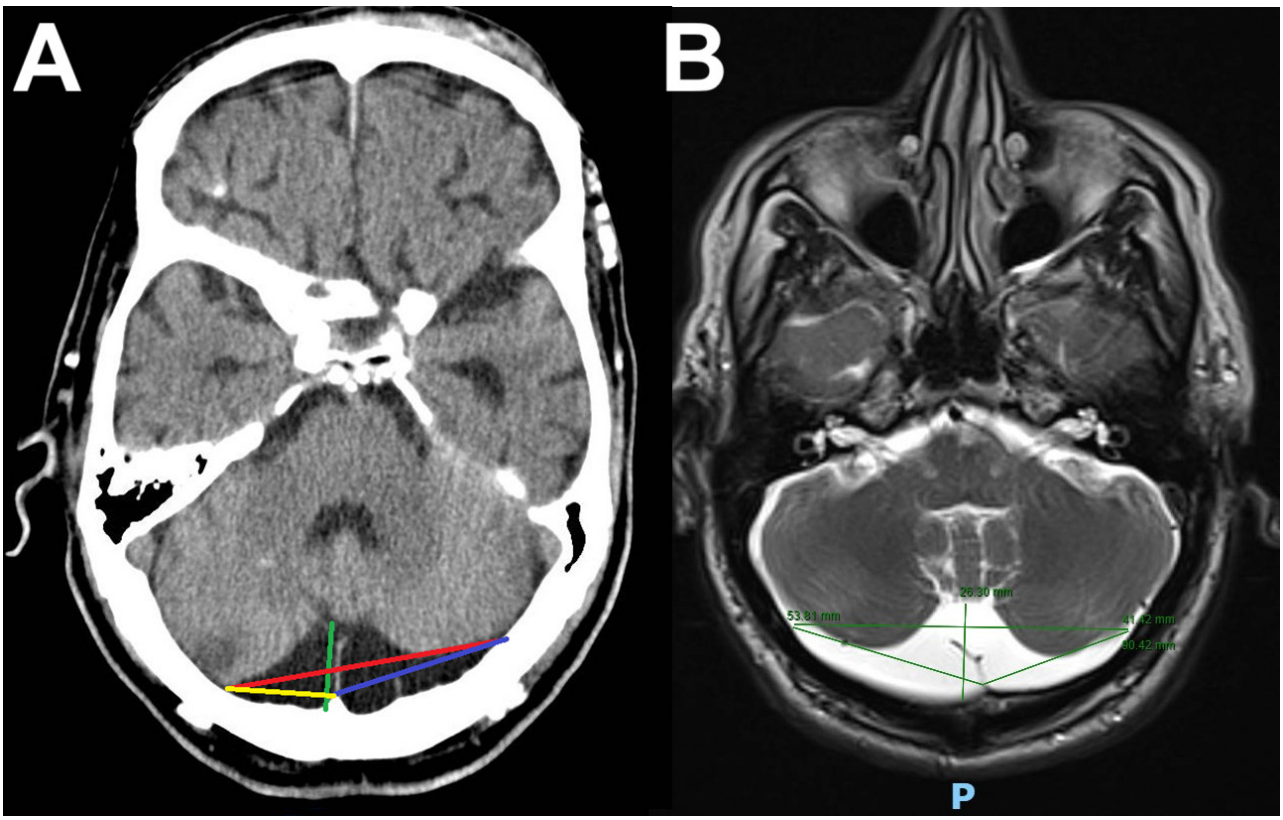

Figure 2. *Measurements applied to the brain CT scan (A) and MRI scan (B). The green is the length, the yellow is the right wing width, the blue is the left wing width, and the red is the whole width of the MCM on the brain CT.*

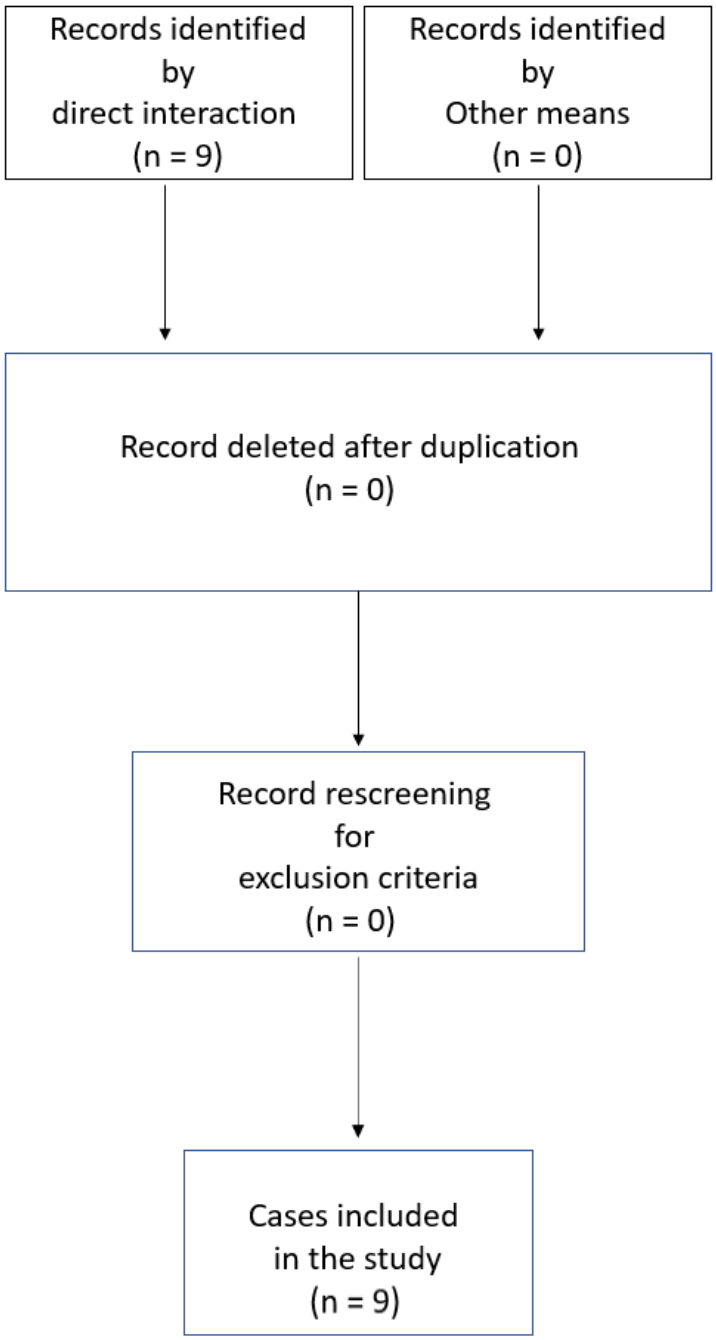

Diagram 1. A STARD flow diagram to highlight the collection method and exclusion creteria.

Table 1. The collected data of Mega Cisterna Magna patients.

Patient NO.	Sex	Age	MCM Type	Left Wing Width in mm	Right Wing Width in mm	Length in mm	Width in mm
1	Male	36	Bilateral	41.80	55.86	33.00	87.75
2	Male	15	Bilateral	34.17	25.15	28.95	60.39
3	Male	51	Bilateral	20.28	30.09	25.75	49.66
4	Male	62	Bilateral	45.46	27.14	26.42	72.84
5	Male	17	Bilateral	27.03	63.66	28.30	88.86
6	Male	30	Contained	6.82*	8.62*	17.87	30.18
7	Male	40	Unilateral	0	45.62	24.96	48.43
8	Male	33	Bilateral	38.39	29.69	25.12	66.07
9	Male	39	Bilateral	41.42	53.81	26.32	90.42
Mean	All Males	35.88	7 Bilateral 1 Unilateral 1 Contained	28.37	37.73	26.29	66.06

* The wings are not present in this case but they were estimated from the midline.

mid-saggital MRI/CT images and an enlarged occipital fossa can be present [6]. In the literature, the measurements were taken from the posterior surface of the cerebellum to the inner table of the occipital lobe [7]. This paper will depend on the same anatomical landmarks for measurements. Even though the MCM could be located caudally to the cerebellum, see (Fig. 1). All that space behind the brain stem will be ignored by measuring from the posterior surface of the cerebellum, which appeared to be more than 35 mm in this case see (Fig. 1).

Epidemiology

Among 19,301 cases who underwent a brain CT or MRI for headaches or mild head truma which showed that only a 49 cases have MCM which estimated as 2.5 per 1000 cases [8]. Another study showed there is no significant gender prediction of MCM [9].

Case Series

In this case series, a group of 9 patients who have MCM on a brain CT scan will be studied and evaluated. Measurements of the MCM like; length, width, and wings' width will be collected and analyzed see (Fig. 2).

Methodology

Any patient from any age group, sex, ethnicity, race, or nationality with normal ventricles, an intact cerebellar vermis, and an enlarged cisterna magna were included in this case study. The cisterna magna must be measured >10 mm from the posterior surface of the cerebellum. The exclsion creteria is any case with pathological MCM that is caused by hydrocephalus, arachnoid cyst, epidermoid cyst, Dany-Walker variant, persistent Blake's pouch cyst, cerebellar atrophy/hypoplasia, and polycystic astrocytoma see (Diagram 1). All cases received a radiology report that indicated having a normal anatomical variant, "Mega Cisterna Magna." The measurements were applied as indicated below see (Fig. 2).

Results

The 9 cases in this paper were all male patients and the average age was 35.88 years see (Table 1). The most common type is bilateral MCM, which is found in 7 cases; one case is unilateral MCM; and one case is conatiend MCM see (Fig. from 3 thru 6). The average left wing width is 28.37 mm, the average right wing width is 37.73 mm, the average length of the cisterna magna is 26.29 mm, and

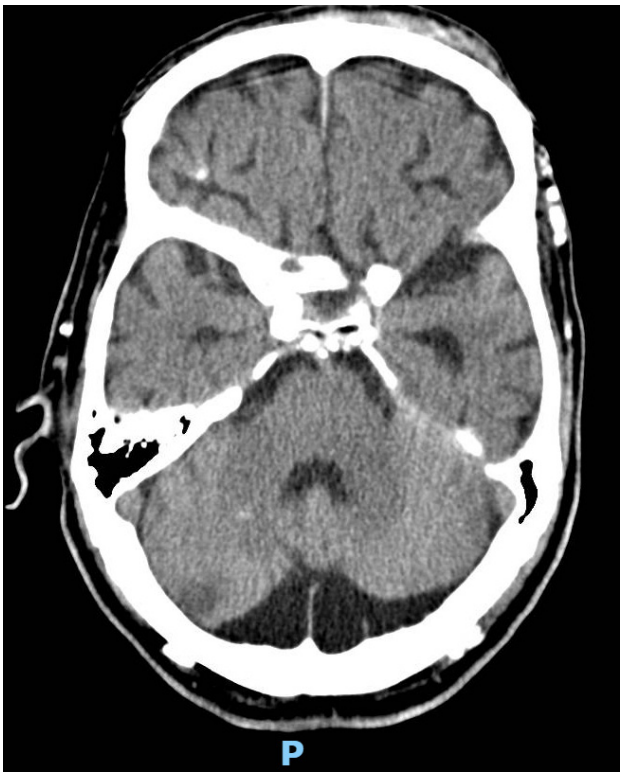

Figure 3. *An axial CT scan of the brain shows a bilateral MCM.*

Figure 4. *An axial CT scan of the brain shows a unilateral MCM right wing.*

Figure 5. *An axial CT scan of the brain shows a MCM confined between two falx cerebelli.*

Figure 6. *An axial CT scan of the brian shows two strands of falx cerebelli separated by MCM with two small wings of MCM on both sides of the falx cerebelli. There is a wing on the left side of the MCM, but no right wing on the right side of the MCM.*

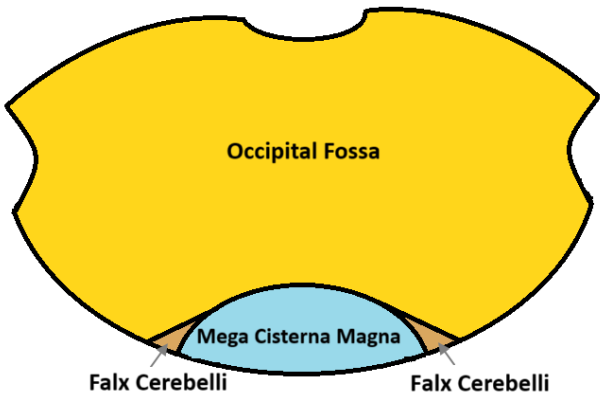

Figure 7. *An illustration of falx cerebelli with two separated strands as an anatomical variation that is separated by MCM.*

the average width of the whole cisterna magna is 66.06 mm see (Table 1).

According to the cases in this random sample, there are three types of MCM: 1) bilateral, 2) unilateral, and 3) contained MCM in the falx cerebelli see (Figs. from 3 through 7). The contained or confined MCM usually elongates vertically, which puts more pressure on the occipital lobe, as seen in (Figs. 5 and 6). The contained or confined part might be the most dangerous type of them. This type was found in one case due to an anatomical variation of the falx cerebelli. The measurements in this case are small in the contained MCM compared with other cases, but the measurement is high in the height of the MCM vertically. It might affect the patient's vision by pressing the occipital lobe see (Figure 8). The anatomical variation in the falx cerebelli (seperated falx cerebelli strands) allows the cerebrospinal fluid to escape to the occipital lobe.

Discussion

The types found in this case study are newly classified in this paper. According to the recent literature, MCM does not affect a specific sex [2], but this paper shows that all the patients that were collected randomly in this paper were all male patients. This might indicate that MCM is more common in male patients than female patients in the population of this study in Saudi Arabia.

The contained type of MCM does not have wings per se, but in this paper, they were estimated from the midline. There might be small wings that measure 1 mm, but they are not well identified in all cases see (Fig. 6). Some

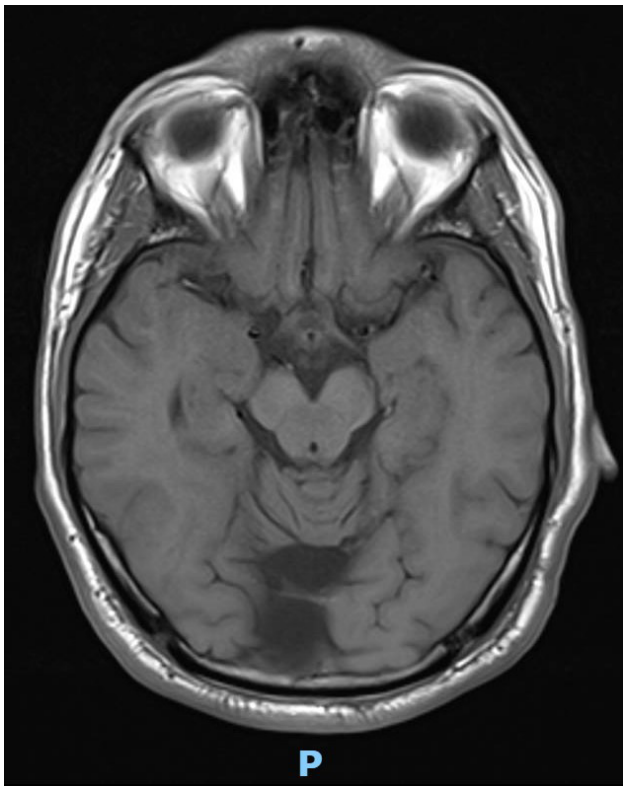

Figure 8. *An axial MRI scan of the brain shows the contained or confined MCM affecting the occipital lobes of the brain.*

cases have no clear wing out of the confined MCM see (Fig. 5 and 8). There is a type of MCM in fetuses in their mothers' uterus called Isolated MCM (IMCM), which has a clinical significance when they turn adults as lower memory performance, verbal fluancy, semantic fluancy, and motor deficits [10, 11].

In a study of 3000 brain CTs, only 11 cases of MCM were found and they were believed not to have any symptoms, treatment, or further study [12]. As well, the majority of the patients who have an MCM are women (i.e. 6 women and 5 men) [12]. This old study ignored the different types of MCM. Recent studies showed that MCM has associations with different psychatric disorders, like obsessive-compulsive disorder, schizophrenia, recurrent catatoniamanic episodes, mania, and psychosis (delusional type) [13, 14].

Conclusion

The MCMs' have a physical affect on the surrounding area, especially in fetuses. As well, it has an effect on the mental status of patients. It has been associated with obsessive-compulsive disorder, schizophrenia, recurrent

catatoniamanic episodes, mania, and psychosis. Three types have been identified in this case series. The most affected are males, compared to other papers.

Limitations and Recommendations

This is a case series with a small number of cases (i.e. only 9) and the gathering methodology is not designed to see which sex is more affected by MCM. Further studies should focus on which type of MCM is associated with which mental illness. **R**

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