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Case Report

Follow-up of syringomyelia due to Chiari type I malformation with phase-contrast magnetic resonance imaging in a professional athlete

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ABSTRACT

Background: Chiari type I malformation (CM-I) is characterized by the descent of the cerebellar tonsils ≥5 mm below the foramen magnum and is frequently associated with syringomyelia (SM). In professional athletes, these conditions may be incidentally discovered following mild trauma. However, the literature offers limited guidance on safe return-to-play criteria.

Case Description: A 22-year-old professional rugby player was diagnosed with CM-I and SM. His only symptom was sleep apnea, confirmed by polysomnography. Magnetic resonance imaging (MRI) revealed a 17 mm tonsillar descent and a C3–C4 syrinx. Craniocervical decompression with duraplasty was performed. Five months postoperatively, the phase-contrast MRI (PC-MRI) demonstrated persistent SM with cerebrospinal fluid (CSF) flow velocities of 10 cm/s. By 16 postoperative months, the syrinx had resolved, and CSF velocities normalized. These findings guided the decision to clear the patient to return to professional contact sports.

Conclusion: In this case, PC-MRI provided objective postoperative data that determined sufficient recovery from CM-I decompression and allowed the 22-year-old athlete to return to his high-impact sport.

Keywords: Cerebrospinal fluid flow dynamics, Chiari type I malformation, Contact sports, Phase-contrast magnetic resonance imaging, Syringomyelia

INTRODUCTION

Chiari type I malformation (CM-I) is defined as the descent of the cerebellar tonsils ≥5 mm below the foramen magnum. It occurs in 0.9% of the adult population.[8] This downward tonsillar displacement may partially or completely obstruct cerebrospinal fluid (CSF) flow with changes in its velocity at the craniocervical junction, leading to the development of syringomyelia (SM) in 60–80% of cases.[4] Measured with phase-contrast magnetic resonance imaging (PC-MRI), CSF flow velocities exceeding 5 cm/s are generally considered pathological.[2]

In athletes, CM-I – with or without associated SM – is frequently diagnosed incidentally, usually after magnetic resonance scans routinely performed after a minor head injury or cervical trauma. In such cases, the potential risks of continuing competitive sports becomes a critical concern.[6] However, there are no robust guidelines regarding when, after CM-1 surgery, these patients can return to sports.[7]

Here, we describe and analyze a professional athlete with CM-I and SM, monitored with PC-MRI, who successfully returned to competitive sports after surgical treatment.

CASE DESCRIPTION

A 22-year-old male professional rugby player presented for the evaluation due to a diagnosis of CM-I with associated SM. Clinically, the only symptom reported was sleep apnea, confirmed by polysomnography. Brain and cervical magnetic resonance imaging demonstrated a 17 mm cerebellar tonsillar descent below the foramen magnum, along with a C3-C4 syrinx [Figures 1 and 2]. The patient underwent a craniocervical decompression with duraplasty using autologous periosteum; the immediate postoperative course was uneventful.

Five months postoperatively, a follow-up PC-MRI demonstrated the persistence of the syrinx and elevated CSF flow velocities at the craniocervical junction (10 cm/s). He was not cleared to return to play at that time. However, by 16 postoperative months, a new PC-MRI showed complete resolution of the syrinx and normalization of CSF velocities (2.3 cm/s) [Figure 3]. Based on these findings and the absence of symptoms, the patient was cleared to resume his professional athletic activity without restrictions. The full clinical evolution is summarized in Table 1.

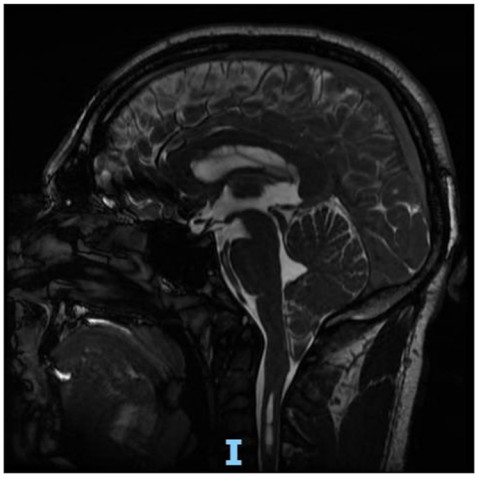

Figure 1: Preoperative T2-weighted sagittal magnetic resonance imaging showing 17 mm descent of the cerebellar tonsils and syrinx extending from C3 to C4. The "I" in CM-I stands for "Chiari type I malformation".

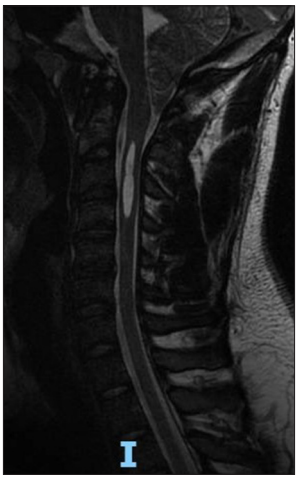

Figure 2: Phase-contrast magnetic resonance imaging at 5 months postoperatively. Persistent syrinx with elevated cerebrospinal fluid flow velocity at the foramen magnum (10 cm/s). The "I" in CM-I stands for "Chiari type I malformation"

DISCUSSION

Return-to-play controversies in CM-I athletes

The possibility of returning to sports in athletes diagnosed with CM-I and SM remains a subject of debate. Wieland *et al.*, evaluated 744 pediatric CM-I cases and found no evidence of severe neurological events linked to sports participation.[10] In contrast, Spencer and Leach reported 21 cases of clinical deterioration following trauma, including four instances of sudden death.[6]

Recently, Turk *et al.*, evaluated 14 athletes (men age: 15 years) with CM-I.[7] Four of them, who practiced American football or volleyball, were asymptomatic before trauma. Following a cranial or cervical concussion, all responded well to conservative management and returned to sports. The remaining ten athletes (mean age: 17.8 years) were symptomatic before trauma and participated in sports such as football (n = 5), baseball (n = 2), lacrosse (n = 1), gymnastics (n = 1), and cheerleading (n = 1). All underwent surgical decompression, and 13 out of 14 returned to athletic activity. A comparative summary of these reports is presented in Table 2.

Our case corresponded to the group of symptomatic patients diagnosed before a sport-related injury. In light of the imaging findings and clinical presentation, the patient was advised to suspend all athletic activity and undergo surgical decompression. After a follow-up of 16 months, with the normalization of the PC-MRI, he was cleared to return to professional sport.

Value of PC-MRI in postoperative evaluation

In our case, PC-MRI proved invaluable as a guide for postoperative follow-up. Previous studies have demonstrated

Table 1: Clinical and radiological follow-up summary.

Time point	Clinical status	MRI findings	CSF flow velocity
Preoperative	Sleep apnea only	CM-I (17 mm), syrinx C3–C4	10.0 cm/s
5-month postoperative	Asymptomatic	Persistent syrinx	10.0 cm/s
16-month postoperative	Asymptomatic	Syrinx resolved	2.3 cm/s
Return to sport	Full return to rugby	Normal PC-MRI flow	NA

CM-1: Chiari type I malformation, CSF: Cerebrospinal fluid, MRI: Magnetic resonance imaging, PC-MRI: Phase-contrast magnetic resonance imaging, NA: Not available

Table 2: Summary of selected studies on athletes with CM-1.

Study	Population	Sports	Symptoms before trauma	Return to play/outcomes
Wieland *et al.*[10]	744 pediatric CM-I patients (462 athletes)	Contact and limited-contact sports	Not specified individually	No catastrophic injuries; all returned to play
Spencer and Leach[6]	21 trauma-related CM-I cases from case reports	Not specified	Mixed (some symptomatic, others unknown)	4 sudden deaths after head/neck trauma
Turk *et al.*[7]	14 athletes (mean age: 17.8 years)	Football, volleyball, baseball, etc.	10 symptomatic; 4 asymptomatic	13 of 14 returned to play (10 postoperative; 4 conservatively)

CM-1: Chiari type I malformation

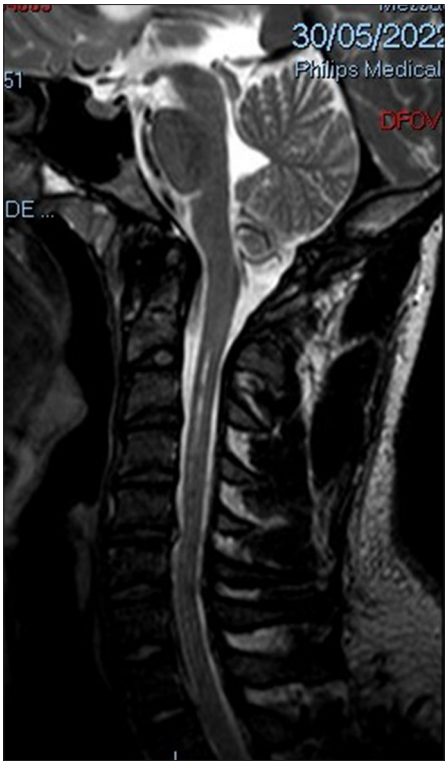

Figure 3: Phase-contrast magnetic resonance imaging at 16 months showing complete resolution of the syrinx and normalization of cerebrospinal fluid flow velocity (2.3 cm/s).

that it can differentiate between symptomatic CM-I and asymptomatic tonsillar ectopia, with a sensitivity of 76% and a specificity of 62%.[3] It is also known that CSF flow velocities decrease after posterior fossa decompression in symptomatic CM-I patients but remain unchanged in healthy individuals.[1] Quantitative measurement of flow velocity is considered more informative than qualitative assessment of flow patterns, especially in the posterior fossa, where tonsillar herniation may alter the flow even in the absence of a true obstruction.

Resolution of SM after CM-I surgery

The postoperative resolution of SM following CM-I surgery is not always immediate. Several series report that SM may take up to 26 months to resolve, with a mean time of 8 months.[5] Other studies show an average resolution time of 6.5 months.[9] In our case, complete resolution occurred at 16 months postoperatively, coinciding with normalization of CSF flow velocities (from 10 cm/s to 2.3 cm/s).

CONCLUSION

In this case, postoperative follow-up using PC-MRI allowed for objective evaluation of syrinx resolution and determination of the appropriate timing for the patient's return to professional athletic activity.

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