CASE REPORT

Transarterial embolisation of a large focal nodular hyperplasia, using microspheres, in a paediatric patient

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SUMMARY

Benign liver tumours are uncommon in children, haemangiomas being the most frequent. Focal nodular hyperplasia (FNH) represents about 2% of paediatric liver tumours. In children, as in adults, a conservative approach is generally recommended. However, large lesions (greater than 5 cm) are more frequent in the paediatric age group, and in these cases, as well as in growing lesions, surgical removal may be advised. Transarterial embolisation (TAE) has been a successful alternative option described in older patients, especially in cases where surgical removal is not possible. This minimally invasive procedure may also become an option in the paediatric group. The authors report the case of a boy with a large FNH treated with TAE using microspheres.

BACKGROUND

Focal nodular hyperplasia (FNH) is a rare entity in children, and few cases have been reported in the literature. Transarterial embolisation (TAE) is a successful alternative to resection and has been described in adult patients.

CASE PRESENTATION

A 15-year-old boy was referred to our department due to the incidental finding of a liver nodule: a hypoechoic focal liver lesion measuring 6 cm at initial presentation (the patient was regularly followed with a yearly ultrasound (US) scan, since the age of 4, due to kidney stones). An outside MRI study was performed and atypical haemangioma was the initial reported diagnosis at the age of 14.

INVESTIGATIONS

In our institution, a new MRI study using hepato-specific contrast agent (gadoxetic acid), disclosed a larger lesion (18 cm at long axis) with imaging features suggesting FNH diagnosis (figure 1). Brain MRI, physical examination as well as laboratory data, including tumoural markers (α-fetoprotein (AFP) and CA19.9), and hormonal studies and carbohydrate deficient transferrin (CDT) were normal.

DIFFERENTIAL DIAGNOSIS

An FNH lesion consists of well-differentiated hepatocytes forming nodules subdivided by fibrous septa, devoid of a fibrous capsule. The central stellate scar contains abnormal arterial vessels without accompanying portal veins. Ductular reaction is usually present at the interface between hepatocytes and fibrous bands, and is highly suggestive of FNH diagnosis.

At the paediatric age, most FNHs are incidental findings; but some predisposing factors have been described. Vascular abnormalities with portal flow deprivation due to congenital or surgical portosystemic shunts, previous chemotherapy or radiotherapy (due to possible vascular injury) and Kasai procedure for biliary atresia, have all been implicated as risk factors for FNH and nodular regenerative hyperplasia (NRH) development.[1–4]

There are no specific clinical manifestations for FNH in children. The majority of the cases are discovered fortuitously for unrelated reasons, as in the presented case. Only one-third of cases are symptomatic, mainly large lesions. The most frequent symptoms are abdominal pain, weight loss and weakness, sometimes in association with a palpable abdominal mass. Tumour rupture and haemorrhage

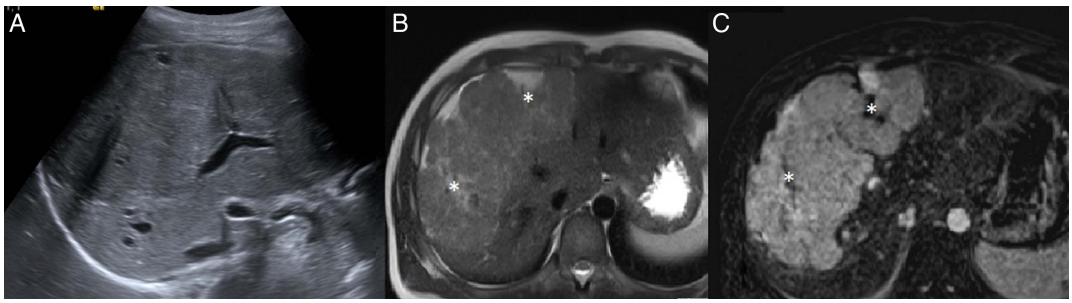

Figure 1 Large hepatic lesion in a young male patient. (A) Ultrasound showing a slightly hypoechoic lesion in the right hepatic lobe; (B) T2-weighted MRI revealing a slightly hyperintense lobulated mass with two central areas of higher signal (asterisks)—central scars. (C) T1-weighted subtraction MRI before and after gadolinium in arterial phase revealing intense nodular enhancement; in the venous phase the lesion was isointense with the surrounding parenchyma. Imaging features suggested a focal nodular hyperplasia diagnosis.

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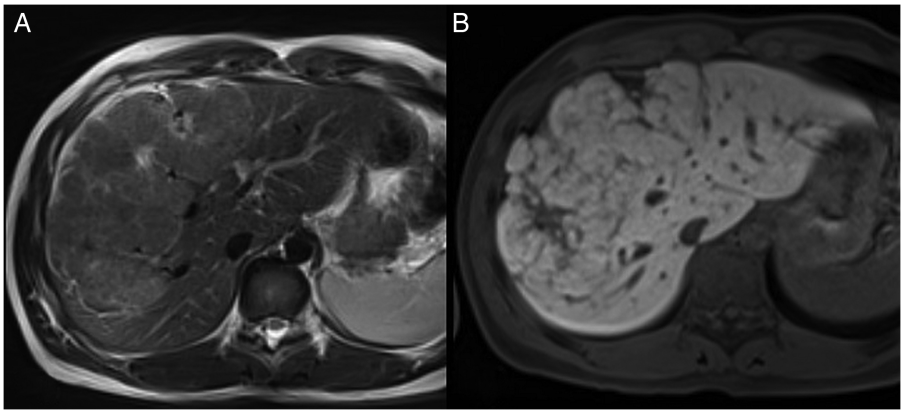

Figure 2 T2-weighted (A) and T1-weighted MRI with fat saturation after hepato-specific contrast agent in the hepatobiliary phase (B). There is a mild enlargement of the lesion; and similar enhancement to the surrounding parenchyma.

are rare events. Laboratory tests including tumour marker AFP do not show abnormal values.[2 5]

FNH imaging features are similar in adults and children. Compared to the surrounding nodule, the central scar is hypodense or isodense on pre-contrast CT images. After contrast, the central scar is usually hypodense in the arterial phase. This last feature has been more common in paediatric cases of FNH, which could be explained by the larger diameter of the lesions.[1–6] However, in patients undergoing post-malignancy treatment, FNH-like nodules are usually multiple and smaller in size; a central scar may be difficult to identify even on MRI study.[3 6]

Enhancement after gadolinium injection is similar to that observed on a CT scan. Liver MRI using a hepato-specific contrast agent may show, on delayed hepatocyte phase images, contrast uptake retention due to the presence of normal quantity and function of organic anionic transporter protein (OATP) 3 receptors at the sinusoidal pole of the hepatocyte, and no excretion due to the lack of normal excretory bile ducts. However, similar behaviour has also been described in well and even moderately differentiated hepatocellular carcinoma, at least in the adult population.[7 8] In the presented case, no significant contrast retention was noted. The use of superparamagnetic iron oxide-enhanced MRI has also been reported in the literature, as a useful method to differentiate FNH in children,[9] but it is no longer commercially available.

Fibrolamellar hepatocarcinoma is an important differential diagnosis as it frequently presents an area of scarring, usually hypointense on T2-weighted images. Features favouring fibrolamellar hepatocarcinoma are the presence of intratumoural calcifications, large size of the central scar, heterogeneity and concomitant presence of lymphadenopathies and/or other metastases.[2 6 10] Hepatic adenoma, especially of the non-steatotic subtypes, may possess some imaging features similar to FNH, but the central scar is less frequent, and associated with less vivid enhancement in the arterial phase and hypointensity in the delayed hepato-specific phase.[11] No contrast retention is observed after hepato-specific contrast in the hepatobiliary phase. Hepatoblastoma usually occurs in younger children and presents as a more heterogeneous and bulky mass.[12] Regenerative hepatic nodule (NRH) is also a rare entity in children and usually consists of diffuse micronodular transformation, but it may appear as a focal nodule; the differential feature in this case is the absence of strong arterial enhancement.[1] In adults, due to the high specificity of CT and MRI in diagnosing FNH, there is usually no indication for biopsy in the presence of typical radiological features.[13] In children, there is no study validating these criteria. Multiple or larger lesions are also more common in children than in adults, and imaging features are atypical in at least two-thirds of cases.[1–3] In these cases, biopsy of the mass and the non-tumoural liver are performed to assess the diagnosis and rule-out-associated abnormalities of the liver.

In our case, due to the large size (more than 10 cm) of the lesion and its growing pattern, a US-guided biopsy was performed. Histological analysis showed features supporting FNH diagnosis: normal hepatocytes in a trabecular disposition, fibrous septa, ductular reaction and inflammatory infiltrate; large dysplastic arterial vessels were found. Surrounding liver parenchyma was normal.

TREATMENT

A conservative 'wait-and-see' approach was decided on. A 3-month control MRI study showed a mild increase in the lesion's size (18–19 cm at long axis) (figure 2). At this point, the patient had abdominal discomfort and a palpable abdominal mass, so management was reviewed. A very large surgical

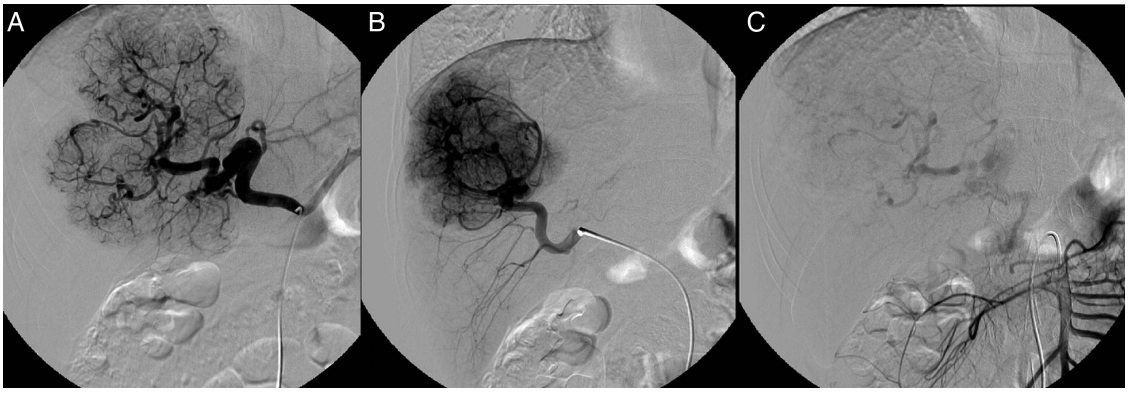

Figure 3 Selective angiographic study showing the two hepatic nodular areas fed by large arterial branches (A and B). Control after transarterial embolisation showing significant decrease in the vascular flow (C).

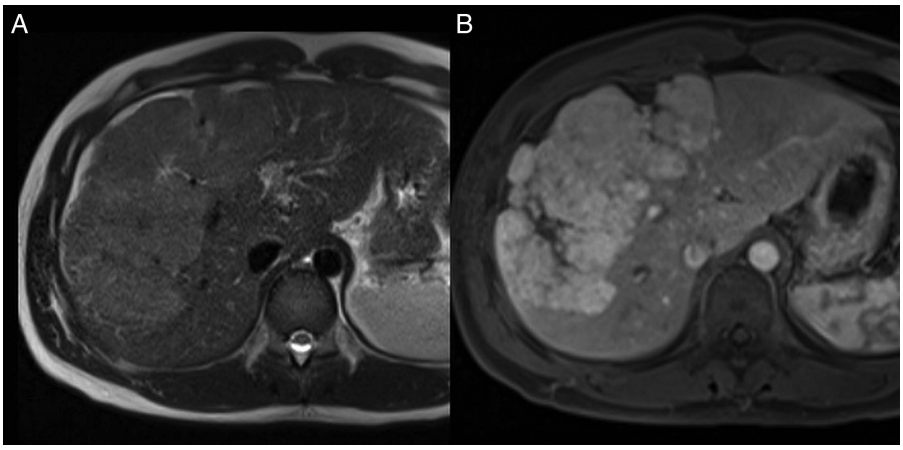

Figure 4 T2-weighted (A) and T1-weighted MRI with fat saturation after gadolinium in the arterial phase (B). No significant decrease in the lesion size was noted, but after gadolinium, there was significant reduction in the arterial enhancement, especially in the more anterior portion.

resection was necessary to remove the entire lesion, so a TAE was proposed. Selective angiographic study revealed two large arterial feeding vessels nourishing the lesion. The larger area was fed by an arterial branch of the celiac trunk and a smaller portion of the tumour was fed by superior mesenteric arterial branches. An aortogram was also performed and no other significant arterial feeders were noted. After subsegmental catheterisation, TAE was performed using microspheres of 300–500 μm (figure 3). A total of 6 mL of microspheres diluted in 40 mL of saline solution and 2 mL of iodine contrast media were used.

OUTCOME AND FOLLOW-UP

No complications were registered after the procedure. A control MRI study performed 3 months later revealed no significant change in size of the lesion, but only a slight decreased enhancement in the arterial phase, especially in the more anterior area (figure 4). A second TAE using microspheres (300–500 μm) was subsequently performed 5 months later (figure 5). In order to reduce it further, arterial feeding of the lesion, a more aggressive approach, was performed in the second procedure. A total of 18 mL of microspheres diluted in saline solution and iodine contrast media were used, until complete nodule embolisation was visually achieved. After the second TAE procedure, the patient developed a transitory postembolisation syndrome with fever and analytic impairment, with full recovery, and was discharged from the hospital on day 7.

After 3 months, a new follow-up MRI study was performed, which showed a significant size reduction of the tumour (from 19 to 13 cm at its large axis) and which also showed reduced arterial enhancement. Some non-enhancing areas due to necrosis were also noted (figure 6). The patient's clinical symptoms reduced considerably.

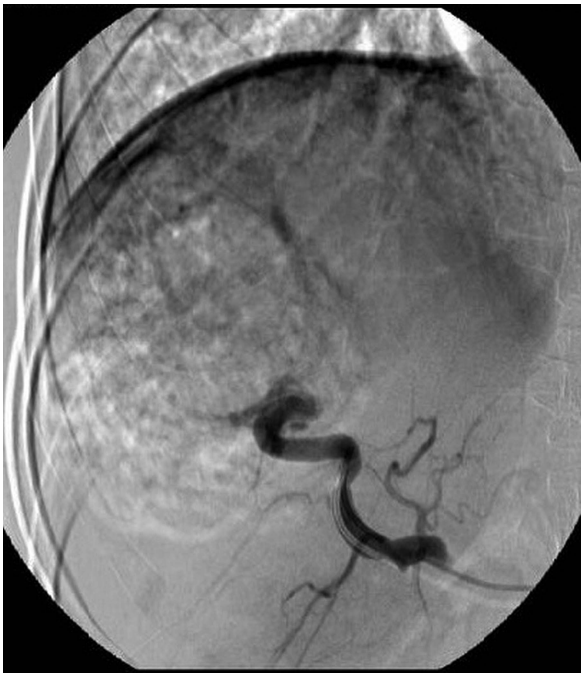

Figure 5 Selective angiographic study of one of the hepatic nodular areas after transarterial embolisation, showing absent arterial flow.

DISCUSSION

Paediatric FNH is a rare entity, representing 2–7% of paediatric liver tumours, and may occur in all paediatric age groups, with no gender dominance.[1 2]

Since FNH is a slow-growing tumour, without known malignant transformation, and is rarely complicated with haemorrhage or rupture; a conservative strategy is advised for asymptomatic children. Surgical resection is usually recommended for symptomatic paediatric patients, patients with increasing size of FNH, or patients in whom malignancy cannot be rule out confidently.[5 14]

The natural history of these tumours is poorly known in children. Some cases of spontaneous regression have been described. Recurrence of FHN after surgery has also been reported in the literature.[2 6]

Cases associated with vascular disorder due to portal deprivation may benefit from restoration of the portal flow, leading to involution of the FNH.[2 6 15] However, hepatoportal sclerosis would contraindicate the closure of the shunt. A case of a widespread FNH invading the whole liver, treated with transplantation, has also been reported.[16]

TAE is described in adults as a successful treatment option, with improvement of symptoms, significant decrease on size and even total involution of the lesion.[17 18] Few paediatric cases of FNH embolisation are reported in the literature and none reported using microspheres.[14 19 20] We present a successful case of significant reducing of a large FNH lesion after TAE using microspheres, with no major complications.

More cases must be reported to evaluate the outcome of the procedure, and to assure its safety in the paediatric age group. Meanwhile, from the authors' point of view, TAE is a valid secure, minimally invasive and efficient procedure in the

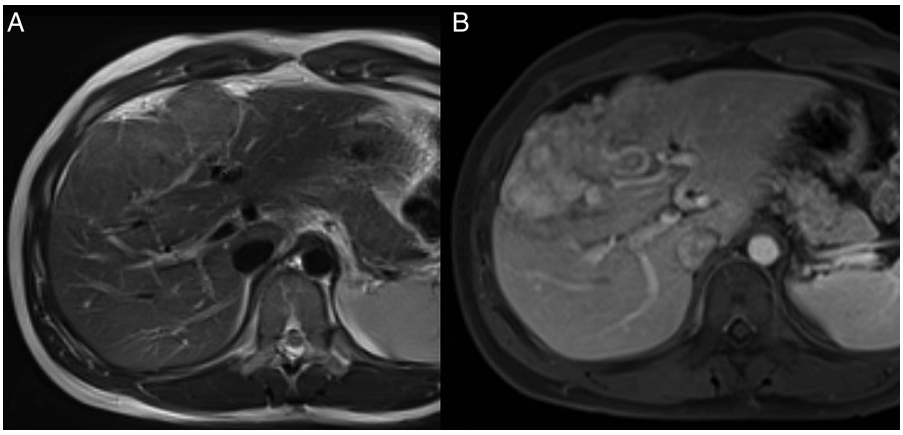

Figure 6 T2-weighted (A) and T1-weighted MRI with fat suppression after gadolinium in the arterial phase (B). There is significant decrease in the lesion size.

treatment of large and growing FNH lesions in the paediatric age group.

Learning points

- Paediatric focal nodular hyperplasia (FNH) is a rare entity, representing 2–7% of paediatric liver tumours.
- Differential diagnosis includes fibrolamellar carcinoma, hepatic adenoma, hepatoblastoma and well-differentiated hepatocarcinoma.
- Surgical removal is recommended in large and/or in growing lesions; otherwise, a conservative approach is indicated.
- Transarterial embolisation may be considered as an efficient procedure in the treatment of large and growing FNH lesions, even in the paediatric age group, when surgical removal is not advised.

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Competing interests None declared.

Patient consent Obtained.

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