

Case Report

Superinfected giant renal hydatid cyst with magnetic resonance imaging and intraoperative correlation

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ABSTRACT

Renal hydatid disease is rare and can mimic a complex renal cyst, abscess, or cystic neoplasm. Preprocedural recognition is essential because inadvertent puncture may cause leakage, dissemination, allergic complications, or infection. A 45-year-old Moroccan man presented with progressive abdominal enlargement and left-sided heaviness. Initial ultrasonography elsewhere showed a giant septated left renal lesion interpreted as a Bosniak II cyst, which subsequently underwent percutaneous puncture. Repeat ultrasonography demonstrated daughter vesicles. Magnetic resonance imaging revealed a 29×28×30 cm left renal cyst with heterogeneous T1- and T2-weighted signal, daughter vesicles, detached membranes, a peripheral low-T2 rim, mild wall enhancement, small gas foci, and heterogeneous diffusion restriction. Surgery demonstrated daughter vesicles and hydatid membranes with purulent material. Histopathology confirmed cystic echinococcosis. Daughter vesicles, detached membranes, and a low-T2 pericyst identify the hydatid origin of a complex renal cyst even when gas, wall enhancement, and restricted diffusion indicate superinfection. Hydatid disease should be considered before puncture or drainage of an atypical renal cyst in endemic regions.

Keywords: Renal hydatid cyst, Cystic echinococcosis, Superinfection, Renal abscess, Magnetic resonance imaging

INTRODUCTION

Cystic echinococcosis, also known as hydatid disease, is a zoonotic parasitic infection caused predominantly by the larval stage of *Echinococcus granulosus*. The liver and lungs are the most frequently involved organs, whereas renal involvement is uncommon, accounting for approximately 2-5% of reported cases. Renal hydatid cysts are usually unilateral, solitary, and cortically located, and isolated renal involvement is particularly rare.¹⁻³

Imaging plays a central role because serological and laboratory findings may be inconclusive. Ultrasonography can demonstrate hydatid sand, floating membranes, and daughter cysts, whereas computed tomography (CT) and magnetic resonance imaging (MRI) more accurately assess internal architecture, local extension, complications, and

relationships with the renal parenchyma and collecting system.^{2,4,5} Superinfection may obscure the classic appearance by producing wall enhancement, complex content, gas, and diffusion restriction, thereby mimicking a renal abscess.¹¹ We report a giant isolated renal hydatid cyst complicated by superinfection after a previous percutaneous puncture.

CASE REPORT

A 45-year-old Moroccan man with rural exposure and no significant previous medical or surgical history presented with progressive increase in abdominal girth, abdominal heaviness, and left flank discomfort.

There was no documented gross hematuria, dysuria, renal colic, or hydatiduria. Fever was not reported at the initial presentation. On admission, he was conscious and

hemodynamically stable. Abdominal examination revealed marked distension with a large, firm, non-tender mass occupying the left hypochondrium, flank, and iliac region, with limited mobility and extension across the midline. There was no guarding, rebound tenderness, or clinical evidence of ascites.

The first abdominal ultrasonography was performed at the referring institution. It demonstrated a giant cystic lesion arising from the left kidney with multiple internal septum-like structures and was initially interpreted as a Bosniak II renal cyst. Color Doppler showed no internal vascularity and no definite solid intracystic component. After referral to our institution, a second ultrasound examination demonstrated multiple well-defined daughter vesicles whose appearance differed from the maternal intracystic fluid, strongly suggesting hydatid disease.

Before hydatid disease was considered, a diagnostic percutaneous puncture of the lesion was performed by the referring urology team. No immediate allergic or hemodynamic complication was documented. The later development of an inflammatory imaging phenotype and the finding of pus at surgery raised concern for secondary superinfection. Given the chronology, the previous puncture may have contributed to this complication, although a direct causal relationship cannot be established.

Laboratory investigations showed eosinophilia and positive hydatid serology, with preserved renal function.

Abdominal MRI demonstrated a giant, well-defined cystic lesion arising from the left kidney and measuring approximately 29×28×30 cm (AP×transverse×craniocaudal), occupying most of the left hemiabdomen. The lesion had heterogeneous internal signal on both T1- and T2-weighted sequences rather than simple homogeneous fluid signal. Multiple rounded daughter vesicles showed signal intensity different from the maternal intracystic fluid, producing a multivesicular cyst-within-cyst appearance. Detached membranes were present, and a peripheral low-signal rim on T2-weighted images corresponded to the pericyst. Small intracystic signal-void foci compatible with gas were identified. Following gadolinium administration, mild wall/pericyst enhancement was present without an enhancing mural nodule or vascularized solid component. Diffusion-weighted imaging demonstrated discrete heterogeneous restriction within the complex intracystic content. This combination suggested secondary infection while preservation of the daughter vesicles and hydatid membranes favored a superinfected renal hydatid cyst over a conventional renal abscess.^{2,4,11}

The lesion exerted marked mass effect on the adjacent abdominal organs, displacing the spleen, pancreas, descending colon, small bowel loops, and stomach. It compressed the contralateral renal pedicle, and the residual left renal parenchyma was markedly compressed and thinned. There was no demonstrated collecting-system

communication, renal vein thrombosis, or suspicious regional lymphadenopathy. No additional hepatic, splenic, pulmonary, or peritoneal hydatid cyst was identified on the available thoracoabdominal CT.

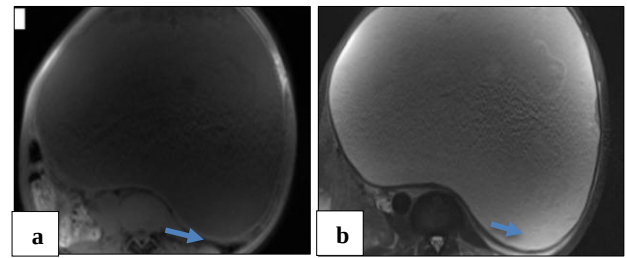


Figure 1: Giant left renal hydatid cyst on sagittal MRI (a) sagittal T2-weighted image demonstrates a very large predominantly hyperintense but heterogeneous cystic lesion occupying most of the left hemiabdomen, with a peripheral low-signal rim (blue arrow) and internal daughter vesicles, and (b) sagittal T1-weighted image shows heterogeneous low-to-intermediate intracystic signal rather than simple homogeneous fluid; the daughter vesicles differ in signal from the maternal cyst content.

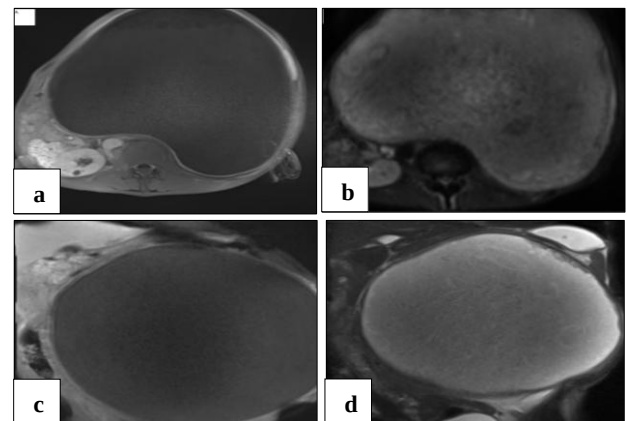


Figure 2: Multisequence MRI features of a superinfected giant renal hydatid cyst (a) coronal T2-weighted image shows the giant multivesicular lesion arising from the left kidney, with marked mass effect and compression of the residual renal parenchyma; (b) coronal post-gadolinium T1-weighted image demonstrates mild peripheral wall/pericyst enhancement without an enhancing solid mural component; (c) diffusion-weighted image shows discrete heterogeneous diffusion restriction within the complex intracystic content, supporting superinfection; and (d) axial post-gadolinium T1-weighted image confirms peripheral enhancement, absence of a vascularized solid nodule, and marked displacement of adjacent abdominal structures.

Overall, the lesion was considered a giant active multivesicular renal hydatid cyst complicated by superinfection. The parasitic morphology was compatible with WHO-IWGE CE2/Gharbi type III, while the wall

enhancement, gas, heterogeneous content, and discrete diffusion restriction reflected the secondary infectious complication rather than the uncomplicated parasitic stage alone.⁵⁻⁷

The patient underwent surgical treatment consisting of partial nephrectomy and complete cystectomy. Intraoperative examination revealed a giant tense renal hydatid cyst containing multiple daughter vesicles, whitish detached membranes, and purulent material, confirming secondary infection. The operative field was protected using pads soaked in a scolical agent, and the cyst was handled carefully to avoid rupture and intraperitoneal dissemination.

Gross pathological examination demonstrated numerous daughter vesicles and laminated membranes. Histological analysis revealed an acellular laminated membrane, an inner germinal layer, and protoscolices surrounded by fibrous and granulomatous inflammatory tissue, confirming renal cystic echinococcosis. The intraoperative purulent material and inflammatory imaging features supported the diagnosis of superinfection. The postoperative course was favorable. Albendazole was administered as antiparasitic therapy.

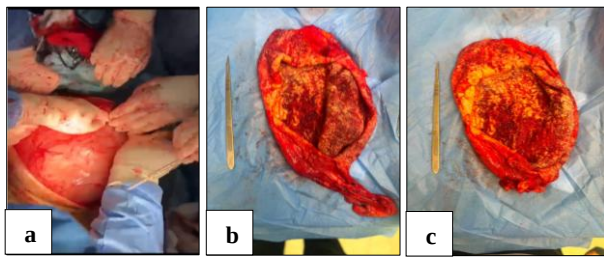


Figure 3: Intraoperative and surgical specimen appearance (a) operative exposure of the giant left renal cyst, and (b and c) resected renal specimen showing the thick cyst wall and hydatid contents. Intraoperatively, daughter vesicles, detached hydatid membranes, and purulent material were identified, supporting a superinfected renal hydatid cyst.

DISCUSSION

Renal hydatid disease is an uncommon manifestation of cystic echinococcosis. The parasite may reach the kidney through systemic arterial circulation after bypassing the hepatic and pulmonary filters or, less commonly, through lymphatic pathways. Renal cysts are most often solitary, unilateral, and located within the renal cortex, where their slow growth progressively compresses the adjacent parenchyma.²⁻⁴

Because the kidney can accommodate a slowly enlarging lesion, renal hydatid cysts may become very large before producing symptoms. Abdominal distension, a palpable mass, and nonspecific flank discomfort are therefore frequent presentations of giant lesions. Communication

with the collecting system may result in renal colic, hematuria, infection, or hydatiduria. In the present case, secondary infection modified the classic cystic appearance and created a clinically important overlap with renal abscess.

Imaging features

Ultrasonography is generally the first-line examination for abdominal cystic echinococcosis. It can demonstrate the cyst wall, hydatid sand, daughter vesicles, and floating detached membranes and forms the basis of the WHO-IWGE and Gharbi classifications.⁵⁻⁷ Typical sonographic signs include a double-wall sign, hydatid sand, a multivesicular honeycomb or wheel-spoke appearance, detached membranes producing the water-lily sign, heterogeneous degenerative content, and wall calcification.

In this patient, the daughter vesicles were initially mistaken for simple internal septa on the first external ultrasound. Repeat ultrasonography more clearly demonstrated daughter vesicles whose appearance differed from the maternal intracystic fluid. In endemic regions, apparent “septa” within a giant renal cyst should therefore prompt a deliberate search for daughter vesicles, detached membranes, and hydatid sand before applying a Bosniak category.

CT is particularly useful for demonstrating wall or septal calcification, daughter cysts, detached membranes, intracystic gas, infection, rupture, and extension into the perinephric spaces. Superinfection may cause wall thickening or enhancement, inflammatory fat stranding, gas formation, or an air-fluid level, potentially mimicking a renal abscess.^{2,4,11}

MRI offers superior contrast resolution for the internal parasitic architecture. The maternal cyst usually has low T1 and high T2 signal, but infection, hemorrhage, or proteinaceous content may make the signal heterogeneous. Daughter vesicles may show signal intensity different from that of the maternal matrix because of differences in protein concentration and biological stage. This discrepancy was a key diagnostic clue in our patient. A low-signal-intensity rim on T2-weighted images corresponds to the collagen-rich host pericyst.^{2,4}

Detached membranes appear as serpiginous low-signal structures floating within the cyst. Viable parasitic components do not enhance; enhancement is usually confined to the host-derived pericyst or surrounding inflammatory tissue. Diffusion-weighted imaging should be interpreted cautiously: uncomplicated hydatid fluid generally shows facilitated diffusion, whereas infected or protein-rich content may demonstrate focal or heterogeneous restriction. Thus, diffusion restriction may support superinfection but cannot alone distinguish a superinfected hydatid cyst from a renal abscess.

Table 1: Differential diagnosis.

Differential diagnosis	Typical imaging features	Features favoring superinfected renal hydatid disease
Simple or minimally complicated renal cyst	Homogeneous simple fluid, thin smooth wall, no internal enhancement.	Daughter vesicles, detached membranes, heterogeneous infected content, and a T2-hypointense pericyst.
Hemorrhagic/proteinaceous cyst	T1 hyperintensity or internal debris without parasitic architecture.	Cyst-within-cyst architecture and recognizable daughter vesicles are not expected in a simple hemorrhagic cyst.
Cystic renal cell carcinoma	Irregular enhancing wall or septa, enhancing mural nodules, solid tissue, possible venous invasion.	Absence of a vascularized solid nodule plus daughter vesicles and hydatid membranes.
Multilocular cystic nephroma	Well-circumscribed multilocular lesion with enhancing septa.	No hydatid sand, detached membranes, or true daughter vesicles.
Renal abscess	Thick/irregular enhancing wall, purulent content, diffusion restriction, inflammatory change, possible gas.	A superinfected hydatid cyst may share these signs; daughter vesicles, detached membranes, cyst-within-cyst architecture, and low-T2 pericyst favor hydatid disease.
Renal lymphangioma	Multiloculated perirenal/peripelvic cystic lesion that may surround adjacent structures.	Lack of a defined maternal cyst, daughter vesicles, detached membranes, or characteristic pericyst.
Calyceal diverticulum/focal hydronephrosis	Communication with collecting system and delayed filling with contrast.	No urinary communication and preservation of parasitic internal architecture.

WHO-IWGE, Gharbi and Bosniak classifications

The WHO-IWGE ultrasound classification separates cystic echinococcosis into active, transitional, and inactive stages: CE1 is an active unilocular cyst with a double-wall sign and possible hydatid sand; CE2 is an active multivesicular cyst containing daughter vesicles; CE3a contains detached membranes; CE3b consists of a predominantly solid matrix with daughter vesicles; CE4 is a heterogeneous degenerative cyst without daughter vesicles; and CE5 has a thick partially or completely calcified wall.⁵⁻⁷ The corresponding Gharbi type III describes a multivesicular cyst.

The Bosniak classification, version 2019, stratifies the probability of malignancy in cystic renal masses on contrast-enhanced CT or MRI.^{8,9} It is not an etiological classification and should not replace the search for infectious or parasitic causes. A giant multivesicular renal lesion in an endemic setting should raise suspicion for hydatid disease even if initially described as a low Bosniak category.

Percutaneous puncture and superinfection

The percutaneous puncture performed before referral is an important learning point. When hydatid disease is unrecognized, diagnostic puncture may cause leakage of antigenic fluid, secondary implantation, allergic complications, or infection. In this patient, the later infected imaging phenotype and intraoperative finding of pus raise the possibility that the previous puncture

contributed to secondary superinfection. This temporal association is plausible but cannot establish causality.

The diagnostic challenge is clinically important because a conventional renal abscess may be treated by percutaneous drainage, whereas an unrecognized hydatid cyst requires a different strategy to avoid uncontrolled spillage and secondary dissemination. Planned percutaneous hydatid procedures such as PAIR are distinct from an unplanned diagnostic puncture and should be performed only in selected cases by experienced teams under appropriate antiparasitic and resuscitation precautions.^{1,10}

Therapeutic management

For large symptomatic renal hydatid cysts with major mass effect, complications, or severely compressed renal parenchyma, surgery is generally favored, with nephron-sparing treatment whenever technically feasible.^{1,3} Operative principles include protection of the surgical field, avoidance of uncontrolled rupture or spillage, use of an appropriate scolicidal strategy, and preservation of viable renal tissue when possible. Albendazole is commonly used perioperatively.

When bacterial superinfection is present, antibacterial therapy should additionally be guided by clinical severity, microbiological cultures, and local susceptibility patterns.

In this patient, partial nephrectomy was performed because of the giant lesion and marked compression of the residual renal parenchyma, followed by albendazole therapy.

CONCLUSION

Giant renal hydatid cysts are rare and may closely mimic benign complex cysts, cystic renal tumors, or renal abscesses. Superinfection further complicates interpretation by producing heterogeneous T1/T2 signal, wall enhancement, intracystic gas, and diffusion restriction. Recognition of daughter vesicles with signal different from the maternal cyst fluid, detached membranes, and a low-T2 pericyst remains essential for identifying the underlying parasitic disease.

In endemic settings, hydatid disease should be considered before diagnostic puncture or drainage of an atypical complex renal cyst. In the present case, a previous percutaneous puncture preceded an infected imaging phenotype, and surgery demonstrated pus together with classic hydatid structures. Distinguishing a conventional renal abscess from a superinfected hydatid cyst is clinically critical because their interventional management differs substantially.

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