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CASE REPORT

Hepatobiliary scintigraphy in a toddler with intrahepatic biliary leakage

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ABSTRACT

A 2.5-year-old boy presented with abdominal pain and progressive jaundice three weeks after involvement in a car rollover accident. Initial abdominal ultrasonography demonstrated a hypoechoic lesion in segment VIII of the liver, raising suspicion for an intrahepatic biloma versus a resolving hematoma. To assess a possible biliary injury, hepatobiliary scintigraphy was performed. Although early dynamic images were nondiagnostic, posing a potential false-negative pitfall, extended delayed imaging up to six hours revealed gradual radiotracer accumulation within the lesion, consistent with an active intrahepatic bile leak leading to biloma formation. Given the patient's symptomatic presentation and evidence of a slow yet active bile leak, percutaneous drainage was successfully performed. This case highlights the importance of differentiating active intrahepatic biloma from hematoma while facing a hypo-attenuating lesion on CT imaging in the post-traumatic setting, a distinction that can be effectively achieved using hepatobiliary scintigraphy with a standardized imaging protocol that includes prolonged delayed imaging and oblique projections to minimize false-negative interpretations caused by slow tracer accumulation or overlapping physiologic activity.

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INTRODUCTION

Biloma is a rare localized collection of bile, most commonly resulting from trauma or iatrogenic injury [1, 2]. Clinical presentation is often nonspecific, including abdominal pain and jaundice, making early diagnosis challenging and leading to a delay in appropriate management. Conventional imaging, such as ultrasound or CT, may identify hepatic lesions but cannot reliably distinguish biloma from hematoma or assess bile leak activity [3]. Hepatobiliary scintigraphy offers a sensitive, noninvasive method to detect active biliary leaks; however, false-negative or indeterminate findings may occur when imaging protocols are not sufficiently extended or optimized. We report a pediatric case of post-traumatic intrahepatic biloma in which delayed imaging and oblique projections were essential for accurately confirming an active bile leak and guiding percutaneous management.

CASE PRESENTATION

A 2.5-year-old boy sustained multiple injuries from a rollover car accident three weeks prior and presented with a left femoral fracture, as well as hepatic and splenic lacerations. He complained of abdominal pain accompanied by jaundice. Ultrasound evaluation identified a hypoechoic lesion in segment VIII of the liver, raising suspicion for either a hematoma or a biloma. Subsequent contrast-enhanced CT imaging demonstrated no enhancement within the hypodense lesion in segment VIII. Laboratory investigations revealed a total bilirubin level of 15.2 mg/dL, direct bilirubin of 8.6 mg/dL, AST of 107 U/L, ALT of 113 U/L, and an ALP level of 3,535 U/L. Therefore, to characterize the hepatic lesion and evaluate for an active intrahepatic bile leak, hepatobiliary scintigraphy was performed. A dose of 1.5 mCi (55 MBq) of [^{99m}Tc]Tc-BrIDA was administered intravenously. Dynamic imaging was performed over a 60-minute period with one-minute frame intervals; (Figure 1A) depicts the final twenty minutes of the dynamic acquisition, followed by static images obtained in the left anterior oblique and right posterior oblique projections, as shown in (Figure 1B). In the initial dynamic images, tracer activity gradually accumulated in segment V of the liver, appearing more pronounced and distinct on the posterior view. However, a photopenic area was observed in the right upper quadrant of the right hepatic lobe, just beneath the diaphragmatic surface (Figure 1A, arrowheads).

Although the photopenic area was not clearly visible in the posterior view of the dynamic images—likely due to overlapping activity from segment VII of the liver—it was confirmed on the oblique static images obtained after the dynamic scan (Figure 1B, arrowheads).

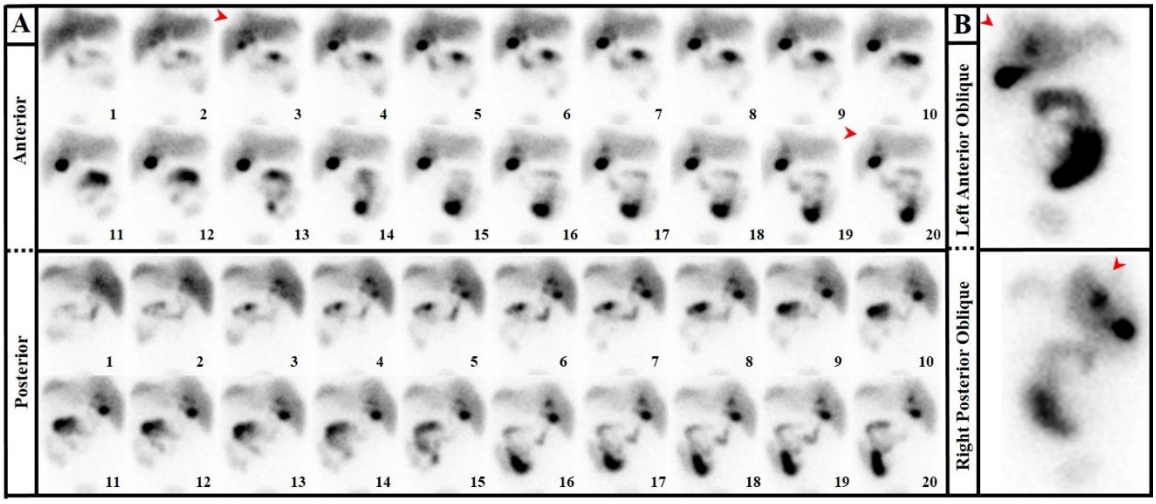

Figure 1. Dynamic hepatobiliary scintigraphy performed over 60 minutes following intravenous administration of 55 MBq of [^{99m}Tc]Tc-BrIDA. (Panel A) Final 20 minutes of the dynamic acquisition demonstrate gradual tracer accumulation in segment V of the liver, with a photopenic area identified in the right upper quadrant beneath the diaphragmatic surface (arrowheads). The photopenic region is less conspicuous on the posterior dynamic view, likely due to overlapping activity from segment VII. (Panel B) Static images obtained in the left anterior oblique and right posterior oblique projections confirm the presence of the photopenic area (arrowheads), improving lesion conspicuity and raising suspicion for a biloma

For a more precise anatomical assessment, SPECT/CT images were acquired following the initial dynamic scan and correlated with the lesion identified on the contrast-enhanced CT (Figure 2A). The SPECT/CT demonstrated a hypodense area in segment V of the liver, suggestive of a ruptured or dilated biliary tract, which exhibited radiotracer activity on the SPECT component, with the elongation of the tracer uptake more prominently visualized in the anterior slices on the coronal view (Figure 2A, green arrows). Conversely, the larger hypodense area in segment VIII showed no activity (Figure 2A, red arrows), consistent with either a hematoma or an inactive bile leak. However, in the upper slices of both the SPECT/CT and contrast-enhanced CT, the hypodense areas appeared connected (Figure 2A, yellow arrow), supporting the interpretation of a biloma encompassing the entire lesion. If hepatobiliary scintigraphy had been limited to the early dynamic phase, the findings could have been misinterpreted as negative for bile leak, representing a potential diagnostic pitfall. Therefore, to determine whether the bile leak was active or inactive, the imaging protocol was extended with delayed static images up to six hours post-injection (Figure 2B). Notably, the delayed images revealed gradual filling of the photopenic area in segment VIII, indicative of an active bile leak, most clearly visualized on the six-hour static images (Figure 2B, red arrows).

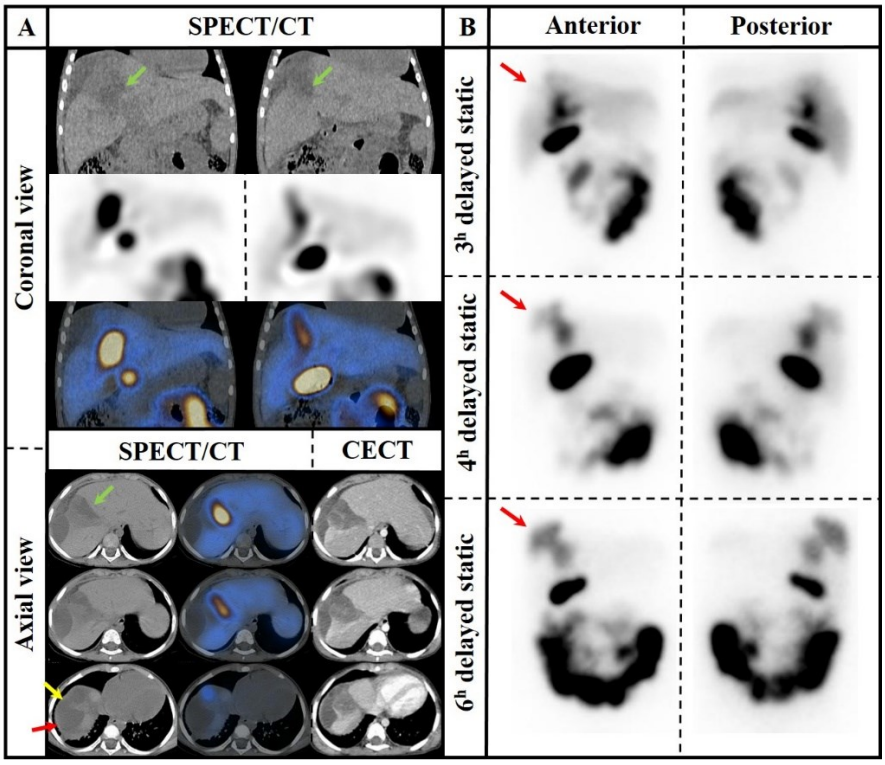

Figure 2. (Panel A) Fused SPECT/CT images correlated with contrast-enhanced CT demonstrate a hypodense lesion in segment V of the liver with radiotracer uptake on the SPECT component, suggestive of a ruptured or dilated biliary tract (green arrows). A larger hypodense area in segment VIII shows no tracer activity (red arrows), suggesting either a hematoma or an inactive bile leak. In superior slices, continuity between the two hypodense regions is observed (yellow arrow), supporting the diagnosis of a biloma involving the entire lesion. (Panel B) Delayed static images acquired up to six hours post-injection reveal progressive tracer accumulation within the previously photopenic area in segment VIII (red arrows), confirming the presence of an active bile leak

DISCUSSION

Accurate diagnosis of biloma—a rare condition characterized by intra- or extrahepatic bile accumulation, commonly resulting from trauma or iatrogenic injury—is essential, as delayed detection can lead to significant morbidity and mortality [1, 2]. The diagnosis is typically suspected based on a characteristic history, including right upper quadrant abdominal pain or recent abdominal trauma [2]. Free or contained peri- or intrahepatic low-attenuation fluid collections identified on ultrasound or CT in the setting of recent trauma or hepatobiliary intervention should raise suspicion for a bile leak rather than being attributed solely to more common postoperative or posttraumatic entities such as hematoma or seroma. As highlighted in prior studies, these collections may appear indistinguishable on conventional cross-sectional imaging, leading to diagnostic

uncertainty and delayed management. A multimodality imaging approach is therefore essential, as it allows not only improved lesion characterization but also functional assessment of bile excretion [3]. The majority of bilomas resolve spontaneously without intervention; however, percutaneous drainage is recommended for active biloma, infected or symptomatic cases [2, 4-5]. Furthermore, stenting and sphincterotomy can be utilized to alleviate the transpapillary biliary-duodenal pressure gradient during ductal healing, while surgical irrigation is seldom necessary in cases of bile peritonitis [4, 6]. Hepatobiliary scintigraphy is a relatively non-invasive, physiologic imaging modality with high sensitivity and specificity for confirming the diagnosis of a bile leak [6-9]; however, careful consideration must be given to potential pitfalls and mimics, such as bile accumulation in the Roux limb in patients' post-Roux-en-Y hepaticojejunostomy, which can simulate a bile leak [10]. Additionally, this imaging modality may help identify the cause of refractory bile leaks or aberrant tracts [9, 11-14].

A key learning point from this case is the risk of false-negative interpretation in early-phase hepatobiliary scintigraphy, particularly in the setting of slow bile leaks or elevated intrabiliary pressure. In such cases, tracer accumulation within a biloma may be delayed, rendering standard early imaging insufficient. Our findings demonstrate that extended delayed imaging can be decisive in confirming active bile leakage, even when initial images are inconclusive. In our presented case, the entire lesion located in segment VIII of the liver eventually accumulated tracer, confirming its identity as a biloma and demonstrating a relatively slow bile leak. Given the patient's symptoms, percutaneous drainage was warranted.

CONCLUSION

Our experience underscores the role of hepatobiliary scintigraphy in differentiating intrahepatic bile leaks from hepatic hematomas, particularly in equivocal post-traumatic settings. It further emphasizes the necessity of comprehensive delayed imaging for accurate lesion characterization, as elevated intrabiliary pressure within a biloma may impede tracer accumulation and result in false-negative findings on early imaging. Moreover, the acquisition of oblique static views is essential for thorough evaluation of suspected biliary leaks, as overlapping hepatic activity can obscure photopenic regions on standard planar projections. Adherence to an optimized imaging protocol is therefore critical to avoid false-negative interpretations and to guide appropriate clinical management.

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