Diagn Interv Radiol 2008; 14:94-96

Adverse effects of barium sulfate in the biliary tract

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ABSTRACT
Reflux of barium sulfate preparations into the biliary tract is rare, but serious complications have been recorded. To consider the implications of such reflux through enterobiliary stents, the literature was reviewed. A case illustrating such an occurrence is presented. Based upon the limited literature available, barium suspension may be retained in particular circumstances and cause or contribute to stent occlusion.

Key words: • *adverse effects* • *barium sulfate* • *biliary tract* • *reflux* • *stents*

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Received 24 January 2008; revision requested 21 March 2008; revision received 30 March 2008; accepted 7 April 2008.

Reflux of orally administered barium sulfate preparations into the biliary tract is rare during examination of the upper gastrointestinal tract, although it was recognized as early as 1915 (1, 2). The majority of reports associate reflux with spontaneous or postoperative fistulae (1, 2), choledochoenterostomy (2, 3), sphincter incompetence (2, 3), and active duodenal ulcer disease (4).

Some authors have set out to deliberately introduce barium sulfate into the biliary tree for diagnostic purposes. Shimaguchi and coworkers used barium sulfate and carbon dioxide via a percutaneous biliary drain (5). Hishida obtained double-contrast cholangiograms intraoperatively, depicting fine mucosal plicae of the common bile duct (6). Both reports, like those describing unexpected reflux of air or barium (7, 8), state that there were no adverse events, with the exception of mild and transient pyrexia in some cases (5). Nonetheless, barium sulfate suspension was washed out into the duodenum with physiological saline solution at the end of the procedure by Hishida, and clearance was confirmed by a postoperative radiograph (6).

There are potential complications from the presence of barium sulfate in the biliary tract. Ductal overdistension may cause cholangiovenous reflux with potential bacteremia, shock, and disseminated intravascular coagulation (9–11). Similarly, acute pulmonary edema has been reported in a child following an upper gastrointestinal barium study in which intravasation was presumed to have occurred (12). Hypersensitivity reactions may rarely lead to mild systemic symptoms and mucosal urticaria (13–15). Acute suppurative cholangitis has been recorded in 2 cases following retention of barium sulfate in the biliary tract for more than 24 hours (16). Finally, retained barium sulfate may become impacted or form choleliths due to progressive water absorption, similar to the process of dehydration and impaction recognized in barium-mediated colonic obstruction (17, 18).

Case report

An 82-year-old male presented with painless jaundice and was found to have a 6.0 cm irregular stricture of the common bile duct, consistent with cholangiocarcinoma on imaging appearances (19). The stricture was traversed by percutaneous positioning of a 0.9 × 10.0 cm internally covered Wallstent® (Boston Scientific Ltd., St. Albans, UK) for long-term palliation. The patient then re-presented with clinical evidence of gastric outlet obstruction. A double-contrast barium meal examination (high density barium sulfate for suspension and effervescent granules, E-Z-EM Ltd., London, UK) did, however, not confirm this, showing duodenal distortion only. Nonetheless, there was instant reflux of contrast medium through the stent (Fig. a) and into several biliary radicles, notably those in the dependent portion of the right lobe of the liver (Fig.

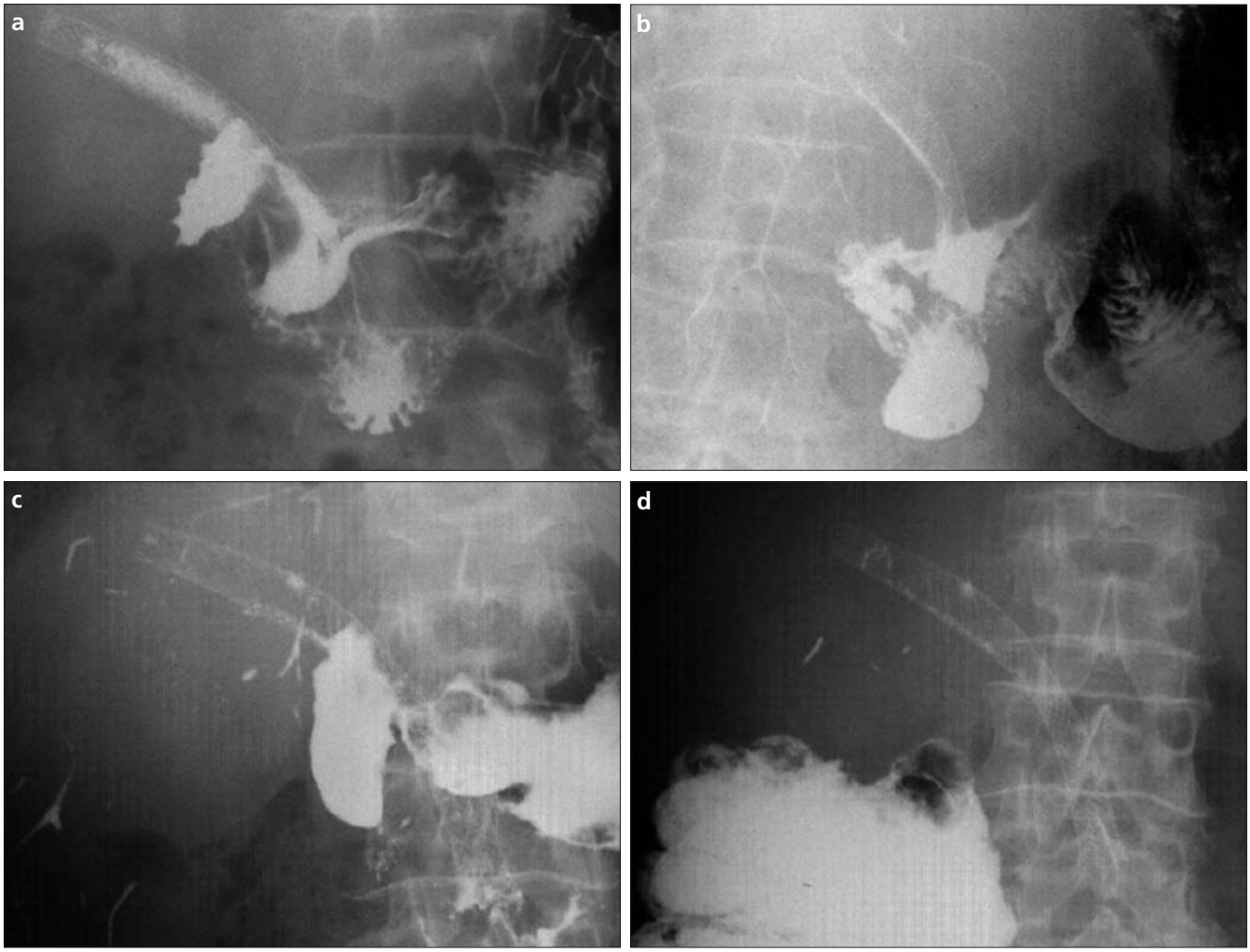

Figure. a-d. Fluoroscopic images from upper gastrointestinal barium series. Distortion with lack of distension of the descending part of the duodenum and reflux of barium suspension through the stent (note that the stent is widely patent) is seen **(a)**, and subsequent image **(b)** when filling of the biliary tree with contrast medium is apparent. Follow-up conventional abdominal radiographs at approximately 4 hours **(c)** and at 22 hours **(d)** demonstrate progressive clearance of barium suspension from the biliary tract.

b). According to medical and nursing records, the patient remained asymptomatic; no rise in body temperature was evident, and biochemical liver function tests did not deteriorate. Serial abdominal radiographs demonstrated almost complete drainage of the barium preparation from the biliary tract with time (Fig. c, d).

Discussion

Most patients with malignant obstructive jaundice have inoperable disease at presentation (20). Although the prognosis is poor, biliary drainage by means of stent insertion offers effective palliation (19–21). The use of plastic and, more recently, expandable metallic stents has become well established for malignant and some cases of benign biliary tract obstruction (22).

Although reflux of air or barium sulfate preparations into the biliary tract is rare in those with normal sphincter of Oddi manometry (7), biliary stents breach the sphincter with the aim of creating a continually patent lumen. This facilitates reflux of duodenal contents, including partially digested food material. Reflux of barium-containing contrast media through biliary stents may therefore be anticipated during the postural manoeuvres involved in a barium meal examination.

Given a physiological bile production of approximately 0.65 dm^3 per day (23), i.e. >0.025 dm^3 per hour, one may expect that the bulk of refluxed material would promptly be washed back into the duodenum. However, the efficacy of such physiological clearance is uncertain, particularly if stent patency is suboptimal.

The commonest complication of biliary stenting is occlusion, recently reported in 31% of patients following Wallstent® insertion (22). Median patency in that study was less than 6 months, however, both the incidence of stent blockage and patency duration may be less (24). The risk of stent occlusion is primarily related to stent material and time *in situ* with duodenobiliary reflux of plant material being an important etiological factor (25, 26). Should reflux of barium sulfate occur through a partially occluded stent, drainage from the biliary tract may be delayed or incomplete with adverse sequelae, particularly cholangitis (16, 27), since the prolonged retention of barium in itself constitutes an important risk factor for complications (11). Furthermore, considering the possibil-

ity of barium dehydration and impaction, barium suspension retained in already partially blocked stents could further promote stent occlusion.

We believe that, with the increasing use of biliary stents, reflux of barium sulfate preparations into the biliary tract will be observed more frequently during examinations of the upper gastrointestinal tract. In addition to the recognized complications of reflux, such as acute cholangitis, consideration should be given to the potential of accelerated stent occlusion, particularly if stent patency is already under question. Should reflux be observed, delayed radiographs and careful clinical monitoring are advised to confirm drainage. Alternative investigations or contrast media, i.e. iodinated, water-soluble agents, may be considered in those at greatest risk or in instances when adequate surveillance is deemed impracticable, e.g. in outpatients. Reports on adverse effects of reflux of barium sulfate through biliary stents should be encouraged to further evaluate the scale and importance of this potential complication.

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