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Scintigraphy in the detection of gastro-oesophageal reflux in children with caustic oesophageal burns: a comparative study with radiography and 24-h pH monitoring

Abstract Background. Caustic injury of the oesophagus not only causes luminal narrowing but is also responsible for longitudinal contraction, resulting in gastro-oesophageal reflux (GOR), which leads to failure of conventional therapy. Therefore, the development of GOR should be investigated periodically to direct appropriate management of these patients.

Purpose. To determine the ability of scintigraphy to detect GOR in children with caustic oesophageal strictures in comparison with barium study and 24-h pH monitoring.

Materials and methods. Seventeen children with caustic oesophageal injury underwent scintigraphy, an upper GI barium study and 24-h pH monitoring within the same week. Five patients were also investigated post-operatively for the assessment of surgical outcome after antireflux surgery.

Results. On the whole, there was good correlation ($r = 0.78$, $P < 0.001$) between scintigraphy and 24-h oesophageal pH monitoring. Scintigraphy detected all but one (9/10) refluxing patients and also correctly identified all (7/7) non-refluxing patients. Barium studies demonstrated 6 out of 10 refluxing patients. There were no false-positive barium studies in non-refluxing patients. Post-operative studies demonstrated no evidence of GOR in surgically treated patients.

Conclusions. Our results indicate that, by comparison with barium studies, scintigraphy is useful in the detection of GOR in cases with caustic oesophageal strictures and may be used as a screening modality for those under clinical follow-up.

Introduction

The ingestion of corrosive substances is an important hazard in young children and may lead to severe damage to the oesophagus. The most common long-term complication is reported to be oesophageal stricture, resulting in oesophageal rigidity and motor dysfunction [1–4]. Nevertheless, caustic injury involving the oesophagus is also responsible for longitudinal contraction, resulting in oesophageal shortening leading to lower oesophageal sphincter (LOS) incompetence with resultant gastro-oesophageal reflux (GOR) [5, 6]. Therefore, GOR occurring on long-term follow-up has been considered as a contributing factor in failure to conventional therapy [3, 5, 7]. This study was designed to evaluate the value of currently available techniques including barium studies, scintigraphy and 24-h ambulatory pH monitoring in the detection of GOR in children with caustic oesophageal strictures and to assess the role of scintigraphy as a screening study.

Materials and methods

Subjects

The study group comprised 17 patients who were receiving dilatation therapy for treatment of caustic oesophageal strictures. The age range was 2–16 years with a mean of 7.4 years. The interval...
between caustic substance ingestion and the imaging studies ranged from 5 months to 10 years. The ingested corrosive substance was sodium hydroxide in all cases. Oesophageal strictures were located in the cervical (n = 3), mid (n = 9) and distal (n = 5) oesophagus.

All patients underwent an upper GI contrast series, scintigraphy and 24-h ambulatory pH monitoring within the same week. The use of any prokinetic and acid blocking medications was discontinued 1 week before the study. Five patients were also investigated by the techniques mentioned above to assess the outcome after antireflux surgery. The study protocol was approved by the institutional ethics committee and all parents gave their informed consent.

Radiography

Upper GI radiological studies were performed after at least 3-h fasting. The patients were given an amount of barium equal to the volume of feed they usually received and were placed in supine and lateral positions. Intermittent fluoroscopy was performed for a total of 5 min. No additional provocative manoeuvres were used, so that the test was as physiological as possible.

Scintigraphy

After fasting at least 3 h, 11–18 MBq 99mTc-sulphur colloid (SC)-labelled milk or juice was administered according to the preference of the child. The radioactive tracer was mixed with half of the volume that the child usually consumed and the remainder, the unlabelled portion, was subsequently given to clear residual oropharyngeal and oesophageal activity. If persistence of tracer was noted, the examination was repeated on the following day by installation of the radiolabelled drink through a nasogastric tube where the tube is removed before the acquisition (n = 8) or gastrostomy tube (n = 4) when appropriate. The patient was placed in the supine position and 60-s anterior images were recorded continuously for at least 45 min without using abdominal compression. Image data were acquired soon after feeding, by using a parallel-hole general-purpose collimator with energy setting on 20% energy window for 140 keV.

Images were reviewed on films and on the computer screen, adjusting the maximum brightness in order to facilitate the detection of equivocal reflux events. Cine-mode images were also taken into account to exclude patient movement. No attempt was made to quantitate the scintigraphic reflux index. Regions of interest (ROI) were drawn over the oesophagus and stomach and time-activity curves were obtained using the summed images (Fig. 1). Spikes of activity over the oesophagus were correlated with the

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Fig. 1a–c Example of a scintigraphic study (patient 15). a Sequential frames. b Computer processing with selection of ROIs over the proximal (2) and distal (1) oesophagus and background area (3). c Generated time–activity curve for the proximal oesophagus with reference to the background curve shows discrete reflux events.