Transmission of *Salmonella enteritidis* following endoscopic retrograde cholangio-pancreatography due to inadequate endoscope decontamination

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We report a historic nosocomial outbreak of *Salmonella enteritidis* affecting four in-patients who underwent endoscopic retrograde cholangio-pancreatography. The cause was attributed to inadequate decontamination of an on-loan endoscope used over a weekend. This report highlights the risks of using on-loan endoscopes, particularly regarding their commissioning and adherence to disinfection protocols. In an era of increasing antibiotic resistance, transmission of enterobacteriaciae by endoscopes remains a significant concern.

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Background

Salmonella gastrointestinal infections are common and occasionally result in chronic asymptomatic carriage. Unsurprisingly therefore, gastrointestinal endoscopes have been recognised as causes of nosocomial *Salmonella* outbreaks for over thirty years [Beecham, 1979; Schliessler, 1980; Hawkey, 1981; O'Connor, 1982]. Although the design of endoscopes makes them intrinsically difficult to clean and decontaminate [Spach, 1993], automated endoscope washer disinfectors (EWD) have overcome many of the difficulties associated manual cleaning of endoscopes. The overall evolution of the process of endoscope decontamination in the last thirty years, of which routine use of EWD is a critical component, means that cross-contamination by enterobacteriaciae should, in theory, be entirely preventable.

However, shortcomings in the commissioning, management and operation of both EWD and endoscopes means that cross-infection may still occur [Spach, 1993; Nelson, 2006; Dirlam Langley, 2013]. More concerningly, spread of enteric bacteria may be possible even when cleaning and disinfection protocols are adhered to, i.e. when there is no failure to follow process but a failure of the process itself [Epstein, 2014]. We describe an occasion where several factors combined to result in an outbreak of *Salmonella enteritidis* involving four patients following endoscopic retrograde cholangio-pancreatography (ERCP) with a duodenoscope.

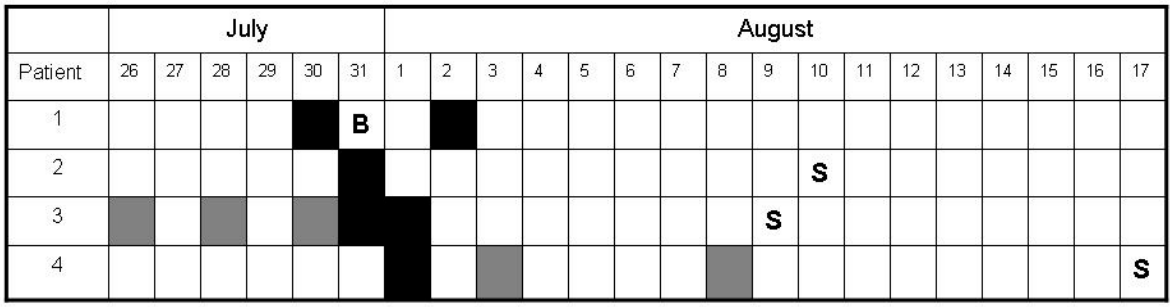
Outbreak description

A bile sample taken at ERCP from Patient 1 (the index case) on July 30th 2005 grew *S. enteritidis* after enrichment in selenite broth. On August 10th a *Salmonella* species was identified in stool samples from Patient 2, prompting an outbreak investigation. A case was defined as any patient from whom *Salmonella spp.* had been isolated and who had had significant contact with Stobhill Hospital between July 11th and August 30th 2005. At the time of the outbreak, Stobhill Hospital was a 440 bed district general hospital in the north of Glasgow, Scotland. Endoscopes were reprocessed in a dedicated room adjacent to theatres. All scopes were manually cleaned and then reprocessed in an automated EWD (Labcaire Autoscope FDT/Twin F) and disinfected with Tristell disinfectant.

Nine patients were identified who had undergone endoscopy over the risk period. Four had undergone ERCP with an on-loan duodenoscope. Four had been treated using two different scopes. All three scopes were reprocessed using the same EWD. No information was available to allow identification of the scope used in the ninth patient. All nine patients received clinical follow-up and had screening of stool samples for *Salmonella spp* by culture.

Faecal screening identified *S. enteritidis* in two further patients (Patients 3 and 4). Patient 3 had symptoms of gastroenteritis, but patient 4 was asymptomatic. There was no mortality or long term morbidity in any patient. All four isolates were confirmed by the Scottish Salmonella, Shigella and *Clostridium difficile* Reference Laboratory to be phage type 8, suggesting cross-transmission. All four affected patients had undergone ERCP by the same operator at the same weekend in the same theatre and using the same duodenoscope (Olympus Model TJF 200), which was on loan from the manufacturer between 29th July and 5th August 2005 (see Figure 1). The endoscope was reprocessed in the same location using the same automated EWD (Labcaire Autoscope FDT/Twin F).

Figure 1: Outbreak chart for transmission of *S. enteriditis* following ERCP procedures



(Footnote for Figure 1 **Black squares** = ERCP performed by loan duodenoscope; **Grey squares** = ERCP performed by different duodenoscope **B** = *S. enteritidis* isolated from bile*;* **S** = *S. enteritidis* isolated from stools)

No Salmonella was identified from faecal screening of other patients and staff, from environmental samples from the theatre furniture and endoscope reprocessing

equipment and sinks, or from water samples from the EWD. No symptoms of gastroenteritis were reported from patients on the same wards as the cases.
We hypothesise that Patient 1 had an ERCP while colonised with *S. enteriditis*. Failure to adequately disinfect the duodenoscope then resulted in cross-transmission to three further patients. Although it is possible that the scope was contaminated with *S. enteriditis* prior to its use on Patient 1, we consider this less plausible.

The endoscopic decontamination area had not been designed as such and a review of the endoscope reprocessing area highlighted several shortcomings. Endoscope cleaning brushes were re-used. There was no dedicated sink for hand hygiene. There were no commissioning data for the EWD and periodic testing had not been undertaken. It was difficult to determine from departmental records whether adequate cleaning of the endoscope and particularly the raiser bridge channel had been undertaken. The EWD was unable to provide data on the adequacy of lumen irrigation with cleaning and disinfectant chemicals. The EWD had no channel patency testing or low level chemical indicator. On subsequent testing the EWD failed the load dryness test and some residual soil remained in the bath. The EWD is no longer used to process ERCP scopes and processing deficiencies have since been rectified. We were unable to obtain validation documentation from manufacturers for the reprocessing of this duodenoscope (Olympus Model TJF 200) in the EWD described (Labcaire Autoscope FDT/Twin F).

Conclusion

We describe the transmission of *S. enteritidis* to three patients following ERCP, a rare cause of nosocomial *Salmonella* infection [Lee, 2013]. The source of the outbreak was most likely an inadequately cleaned and disinfected on-loan duodenoscope. Shortcomings in the commissioning, operation and periodic testing of the EWD were discovered. There were further deficiencies in the disinfection environment and cleaning procedure of the duodenoscope, likely compounded by weekend working and unfamiliarity with the proper procedures for disinfecting the on-loan scope. A lack of co-ordination between endoscope manufacturers, detergent suppliers, disinfectant suppliers and EWD manufacturers further complicates the decontamination of on-loan endoscopes. Use of loan endoscopes, particularly where models do not have proven compatibility with in-house EWD, should be avoided. British guidance has highlighted the importance of adequately trained staff working in a dedicated and suitably equipped decontamination space if endoscopy is to be performed outwith routine working hours (Department of Health, 2013).

This report highlights the potential for cross-transmission of enterobacteriaciae where disinfection procedures are not followed after endoscopy of the gastrointestinal tract. The true prevalence of cross-transmission of enteric bacteria following gastrointestinal endoscopy is unknown. Cross-transmission is typically identified only following recognition of infection with unusual organisms or unusual resistance phenotypes, which likely underestimates the true prevalence. Further work is needed to better characterise the extent and clinical significance of silent transmission of enteric bacteria following endoscopy.

References (10/10)

Beecham HJ, Cohen LC and Parkin WE. *Salmonella typhimurium* transmission by fibreoptic upper gastrointestinal endoscopy. Journal of the American Medical Association 241:1013-15 (1979)

Schliessler KH, *et al*. Outbreak of *Salmonella agona* infection after upper intestinal fibreoptic endoscopy. Lancet x 1246 (1980)

Hawkey PM, *et al*. Contamination of endoscopes by *Salmonella* species. Journal of Hospital Infection 2:373-376 (1981)

O'Connor, BH *et al*. Salmonellosis infection transmitted by fibreoptic endoscopes. Lancet x 864-866 (1982)

Nelson DB and Muscarella LF. Current issues in endoscope reprocessing and infection control during gastrointestinal endoscopy. World Journal of Gastroenterology 12:3953-3964 (2006)

Spach DH, Silverstein FE and Stamm WE. Transmission of infection by gastrointestinal endoscopy and bronchoscopy. Annals of Internal Medicine 118:117-128 (1993)

Dirlam Langlay AM, et al. Reported gastrointestinal endoscope reprocessing lapses: The tip of the iceberg. American Journal of Infection Control. 41:1188-1194 (2013)

Lee MB and Grieg JD. A review of nosocomial *Salmonella* outbreaks; infection control interventions found effective. Public Health 127:199-206 (2013)

Department of Health. Management and decontamination of flexible endoscopes (CFPP 01-06) (2013)

Epstein, L et al. New Delhi metallo-beta-lactamase-producing carbapenem resistant *Escherichia coli* associated with exposure to duodenoscopes. *JAMA* 312:1447-55 (2014)