Journal of Hospital Infection 90 (2015) 70–74

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Short report

Investigating the impact of clinical anaesthetic practice on bacterial contamination of intravenous fluids and drugs

N. Mahida [a,*], K. Levi [a], A. Kearns [b], S. Snape [a], I. Moppett [c]

[a] Department of Clinical Microbiology, Nottingham University Hospitals NHS Trust, Nottingham, UK
[b] Antimicrobial Resistance and Healthcare Associated Infection Reference Unit, Public Health England, London, UK
[c] Anaesthesia and Critical Care, Division of Clinical Neuroscience, University of Nottingham, Nottingham, UK

ARTICLE INFO

Article history:
Received 5 February 2014
Accepted 19 November 2014
Available online 13 January 2015

Keywords:
Syringe
Anaesthesia
Intravenous fluids
Surgery

SUMMARY

Syringes ($N = 426$), ventilator machine swabs ($N = 202$) and intravenous (IV) fluid administration sets ($N = 47$) from 101 surgical cases were evaluated for bacterial contamination. Cultures from the external surface of syringe tips and syringe contents were positive in 46% and 15% of cases, respectively. The same bacterial species was cultured from both ventilator and syringe in 13% of cases, and was also detected in the IV fluid administration set in two cases. A significant association was found between emergency cases and contaminated syringes (odds ratio 4.5, 95% confidence interval 1.37–14.8; $P = 0.01$). Other risk factors included not using gloves and failure to cap syringes.

Introduction

There is increasing recognition of the intra-operative environment as a contributor to healthcare-associated infections (HCAIs) through reservoirs such as anaesthetic machines and poor adherence to hand hygiene by theatre staff.[1–3] For an anaesthetist working single handedly, this may be due to the practical constraints of managing a patient's airway while controlling the anaesthetic machine and giving intravenous (IV) drugs.

There is also considerable variation in the way that IV drugs are drawn up in syringes; some anaesthetists use sterile hypodermic needles, some use 'drawing-up' needles, and others insert the syringe tip directly into vials. Furthermore, studies have shown that syringes can become contaminated, and anaesthetic drugs can support the growth of bacteria.[4–6] A further risk factor is that anaesthetists often administer repeated boluses of IV drugs from the same syringe which can be left capped or uncapped on a tray throughout the operation.

To allow an anaesthetist to deliver IV drugs to a patient covered by sterile drapes, an IV extension line with a three-way tap is usually interposed between the IV administration set and

* Corresponding author. Address: Department of Clinical Microbiology, Nottingham University Hospitals NHS Trust, QMC Campus, Derby Road, Nottingham, NG7 2UH, UK. Tel.: +44 (0)115 9249924x61161; fax: +44 (0)115 970 9767.
E-mail address: nikunj.mahida@nuh.nhs.uk (N. Mahida).

http://dx.doi.org/10.1016/j.jhin.2014.11.024
0195-6701/

the IV access device (Figure 1). The extension line therefore infuses both fluids from the IV administration set and drugs injected by the anaesthetist through injection ports on the three-way tap. There is no guidance on maintaining the sterility of three-way taps, and hence anaesthetists may wash their hands, use alcohol gel, use sterile gloves or perform no hand hygiene before injecting drugs. Several groups have demonstrated bacterial contamination of drugs and fluids infused through three-way taps and IV administration sets in simulated settings, but few studies have assessed 'real-life' anaesthetic practice.[7—9]

Methods

In total, 101 elective and emergency surgical cases were selected for the study based on the availability of the investigator. A questionnaire was distributed to anaesthetists, and microbiological samples were collected.

Ventilator switches and oxygen flowmeter knobs

Ventilator switches and oxygen flowmeter knobs were adjusted regularly by the anaesthetist during surgery. At the end of the procedure, these were swabbed using a moistened charcoal swab and inoculated on to Columbia blood agar (Oxoid, Basingstoke, UK).

Used anaesthetic syringes

Syringes used by the anaesthetist, that remained on a tray for possible further use, were collected at the end of each procedure. Syringe contents cannot be ejected completely from the tip, even if the plunger is fully depressed. In order to standardize the volume of fluid cultured, any IV drugs retained within the syringe were ejected until only the tip contents remained. A sterile needle was connected to the used syringe, and saline was aspirated to increase the volume to 1 ml. This was ejected into a sterile universal container and centrifuged at 1000 *g* for 15 min. The supernatant was discarded and the remaining 100 μl was inoculated on to blood agar. Each syringe tip was also swabbed using a moistened charcoal swab and inoculated on to a blood agar plate.

IV extension line

The used extension line (with the three-way tap attached) was acquired at the end of each procedure, just prior to disposal. Based on a previously described method, 5 ml of 0.9% saline was aspirated into a sterile syringe, injected into the three-way tap and collected at the distal end of the extension line.[7] The effluent was centrifuged at 1000 *g* for 15 min, and 100 μl of the deposit was cultured on a blood agar plate.

All plates were incubated at 37°C for 48 h under aerobic conditions. Presumptive identification of the cultured organisms was based on colonial morphology, Gram staining, and oxidase and catalase tests. Formal biochemical identification was performed using Vitek-2 (bioMérieux, Marcy l'Etoile, France).

For each operative case, if the biochemical identification of bacteria from two sites (ventilator/syringe/IV extension line) matched, antibiotic susceptibility testing was performed to further compare the organisms.[10] If the biochemical identification and antibiogram of bacteria from all three sites matched, pulsed-field gel electrophoresis was used to determine their relatedness.[11]

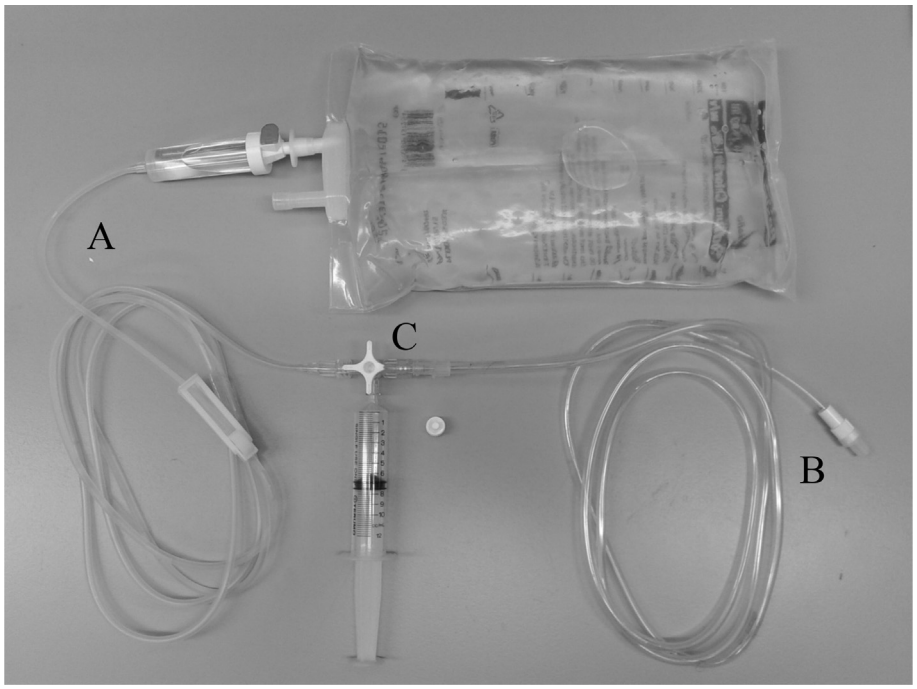

Figure 1. Equipment used to deliver intravenous (IV) fluids and drugs during anaesthesia. (A) IV administration set. (B) IV extension line. (C) Three-way tap connecting A to B. The cap is taken off the injection port and the syringe is inserted to allow concurrent delivery of drugs through the IV extension line.