

RESEARCH ARTICLE

The Golden Touch-Reducing the incidence of *Staphylococcus aureus* Bacteraemia (SAB) in Haemodialysis Patients

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Abstract

Background: *Staphylococcus aureus* bacteremia (SAB) resulting from central Vascular Access Devices is a serious, often preventable complication. Health care associated (HCA) SAB is an infection which is common but often avoidable. A strategic plan was implemented as part of quality improvement to reduce the number of SAB.

Objective: To report the quality improvement project outcome in the dialysis unit on decreasing the *Staphylococcus aureus* bacteraemia (SAB) in haemodialysis patients.

Design: This is a quality improvement project.

Participants: Participants were the South Western Sydney Local Health District dialysis units staff including the clinicians, haemodialysis patients and relatives.

Approach: An audit was conducted with the used of an auditing tool from the Centers for Disease Control, United State of America, specific to auditing cannulation and decannulation of haemodialysis patients. Followed by strategic plan and the intent was to ensure that infection prevention and control is everyone's responsibility: clinicians, ancillary staff, patients, and relatives.

Results: A total of 45 procedures (which included accessing and de-accessing central Vascular Access Devices) were audited on compliance with aseptic non-touch technique.

Conclusion: This quality improvement project has proven that an infection prevention strategy implemented was successful and that the general principles around best practice infection prevention and control could be utilised in other specialty areas.

Keywords: (3-5 keywords): *Chronic kidney disease, Haemodialysis, Staphylococcus aureus* bacteremia

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1. Introduction

A well-functioning vascular access is essential for patient who is undergoing haemodialysis treatment for chronic kidney disease (Noordzij et al., 2014). A fistula is made by joining a vein onto an artery, it creates a large, robust blood vessel that can be needled regularly for use during haemodialysis. Fistula is important as this provides a reliable way of processing high volumes of blood for haemodialysis (Kidney Care UK, 2023a). The current vascular access routes for haemodialysis are (i) creation of an arteriovenous fistula (AVF); (ii) placement of graft that connects the artery and vein (AV graft); or (iii) with a central venous catheter (Lawson et al., 2020). AVF is the recommended gold standard vascular access for haemodialysis due to their prolonged patency, improved durability, and low risk of infection for those that mature (Bylsma et al., 2017). As well as it gives a good flow which increases the effectiveness of dialysis, in turn improving health and wellbeing (Kidney Care UK, 2023b).

1.1 Healthcare Associated Infections / *Staphylococcus Aureus* Bacteraemia

Healthcare associated infections (HAI) continue to cause substantial patient morbidity and cost to health services (Turnidge et al., 2009). The factors critical to the control and reduction of infections include sound hygiene practices, environmental cleanliness and effective methods for disinfection and sterilisation. *Staphylococcus aureus* bacteraemia (SAB) is the major HAI key performance indicator for jurisdictions under the National Healthcare Agreement (Australian Institute of Health and Welfare, 2022). The incidence and rate of SAB are considered to be an alternate marker for the measurement of clinical quality in healthcare facilities (Australian Commission on Safety and Quality in Health Care, 2019). SAB resulting from central vascular access devices (CVAD) is a serious, often preventable complication that can result in significant mortality, increased length of stay (LOS), readmission and increased costs (Turnidge et al., 2009). HAI SAB is an infection which is common but often avoidable (Loftus et al., 2022).

1.2 Background

The population in the South Western Sydney in Australia was estimated at 1,081,070 in the 2016 Census. This district is made up of seven local government areas (LGAs) and is a major region in Australia (South Western Sydney Health District, 2018). The district is among the most rapidly growing

populations in New South Wales (NSW). South Western Sydney residents experience very high rates of kidney failure (KF) and faster progression to dialysis (ANZDATA, 2022). Review of data from the South Western Sydney Local Health District (SWSLHD) showed that 24% of all SAB between March 2015 to March 2017 were caused by either a central vascular access device or AVF infection. A Taskforce was established, and a quality improvement project was commissioned in 2018. This paper will report the success of this quality improvement project.

2 Material and Methods

Haemodialysis units across the SWSLHD reported a total of 28 SAB from the period between March 2015 to March 2017 and were responsible for 24% amongst all reported SAB across the Local Health District. An independent audit was requested by the district Senior Administration and the Infection Control Advisory Committee. The audit tool was developed by the investigator team and the audit was conducted across all haemodialysis units in SWSLHD, resulted in a report issued in March 2018. A Renal Infection Prevention and Control Action Strategy (The Strategy Plan) was subsequently developed which was endorsed by the Organisation's Infection Prevention Unit. This Strategy Plan was co-designed with the patients, their carers and relatives, and reviewed current practices and provided direction for all staff to reduce SAB rate for haemodialysis patients.

2.1 Implementation of the Renal Infection Prevention and Control Action Strategy (The Strategy Plan)

The intent of The Strategy Plan was to ensure that infection prevention and control is everyone's responsibility: clinicians, ancillary staff, patients, and relatives. The Strategy Plan outlined strategic objectives and ensured that accountability and responsibility was documented so that staff 'owned' its implementation. It also included timelines in the form of an action plan to achieve these local goals. The strategies included:

- All renal staff to understand the impact of infection and infection control practices to enable understanding associated with risk to teach patients, other staff, and carer's best practice hand hygiene and aseptic techniques.
- Patients to be treated in a safe physical environment that minimises the risk of infection.
- Renal Nurse Unit Managers (NUM), Clinical

Nurse Consultants (CNC) / Educators together with local Infection Prevention and Control Units to adopt comprehensive surveillance and audit programs to monitor infection control principles including basic hand hygiene.

- Reduction in infection rates to form part of the Cardiovascular Stream and Renal Service's strategies.
- Regular meetings between the Cardiovascular Stream and Renal Service to embed governance, risk management, and performance management.
- The Renal Service and the Infection Prevention and Control Units to develop systems to ensure effective recording, analysis, and sharing of information to assist in managing infections across the district.

Traditionally, infection control strategies focus on audits and compliance. The objectives for The Strategy Plan were implemented to provide clarity regarding the leadership and direction for the management of infection prevention and control, ultimately reducing infection rates. At all times the focus was on positive outcomes. Focus on what the taskforce was trying to achieve and what this positive change meant for patients, carers, staff, and facilities. This allowed the staff to feel a part of the solution and therefore were owners of the solution.

2.2 Implementation Process

An interventional team was established, led by the Cardiovascular Stream Clinical Manager and the Infection Prevention Unit Clinical Nurse Consultant (CNC). This team focused on accomplishing the ANTT component of the Strategy and the Action Plan. Weekly meetings were held with Hospital Executive Leadership Team and the Renal Service senior nurses.

These meetings focused on the 'why' renal patients had such a high infection rate, and the team set goals and actions to break down where the patients may be at risk of acquiring infections. This was not limited to the inpatient setting, but also to the outpatient setting where the renal nurse met with individual patient to determine the process of cleaning at home.

Regular meetings were attended by the medical and allied health staff with nurses led the implementation process. Developing new ways to access lines and new equipment required to support The Strategy Plan was the responsibility of the Clinical Manager. The Chief Executive of the district was also very supportive of the project which reinforced the importance of this project.

2.2.1 Review of Procedures and Guidelines

A review of the current procedures and guidelines was initiated to ensure evidenced-based approach and consistency with infection prevention and control practices across the district. This included a review of the aseptic non-touch technique (ANTT) in line with best practice principles. The review was led by the Infection Prevention Unit CNC and the Dialysis Access Coordinator.

2.2.2 Use of Closed System Connector

Part of the implementation is the use of a closed system connector (a device that proven to reduce vascular catheter related infections) for all vascular catheters (Micklos 2015; Bonkain et.al. 2013). Less than 10% of the closed system connector was used in the dialysis units at the time of the audit. By the end of 2018, 100% of haemodialysis patients with tunnelled vascular catheters were using a closed system connector. In addition, a review was also conducted for the securement dressing that was utilised for all the vascular catheter exit site as well as the use of topical prophylactic ointment post catheter insertion.

2.2.3 Train the Trainer Approach

A holistic approach for practice change was implemented in the Renal Service. An evidence-based 'train the trainer' program was developed by the Renal Service senior nurses. Change in practice was then consistent and in line with best practice across the district. Policies and procedures were updated regarding this change and each staff member read and signed that they were aware of the practice change. They were also credentialed against the updated competency.

The response to poor practices in haemodialysis was to look at a sustainable infection prevention strategy so that staff could feel a part of the solution. The Strategy Plan was designed to ensure that each staff was held accountable for compliance with hand hygiene and ANTT. The actions from The Strategy Plan was led by the Renal Service senior nurses and change champions within the dialysis units. This was reinforced by the presence of the Executive leadership team during the weekly meetings. Individual meeting was held between senior management and the staff who breached adherence to the practices. During these meetings, the focus remained on the positive messages of what the Renal Service would look like for patients with zero infections.

2.2.4 Challenge

The key challenge for prevention and control of HAI in haemodialysis is to ensure that procedures were in place to reduce the risk of acquiring such infections in the community. This was particularly challenging for outpatients at satellite dialysis units who attend haemodialysis two to three times a week and managed their CVAD at home. A brochure was developed and provided to all patients titled “*Hand hygiene for safer dialysis*” which assisted satellite dialysis units’ patients in appropriate hand hygiene techniques when handling their CVAD at home. This assisted with creating and continuing a culture of infection prevention strategies from hospital to home.

For those patients who that had recurring infections, an individual action plan was developed to ensure ANTT was considered and addressed. This was often as simple as providing clean sterile gauze for them to clean the vascular access at their homes.

3. Outcomes

As discussed in the above paragraphs, in consultation with the Renal Service multidisciplinary team, the Cardiovascular Clinical Manager developed the Renal Infection Prevention and Control Action

Strategy (The Strategy Plan) which was endorsed by the SWSLHD Infection Control Advisory Committee. Since its implementation, infection rates reduced from an average of 1.0 cases per month to 0.72 cases per month with zero cases for 28 out of 60 months. The Strategy Plan is now embedded into everyday practice.

A total of 45 procedures (which included accessing and de-accessing CVAD) were audited on compliance with ANTT and hand hygiene. An auditing tool was used from the Centre for Disease Control, USA, specific to auditing cannulation and decannulation of hemodialysis patients. This tool assessed compliance with connection and disconnection of CVAD and exit site care. The average compliance for ANTT between the seven dialysis units was 35% with one unit at 0% compliance (Figure 1).

Dialysis Unit 1 had the lowest rates of ANTT and hand hygiene compliance (Figure 1 & 2) and was noted to have the highest rate of SABs across the District. The Strategy Plan was implemented in June 2018 and was successful in achieving the objectives of ANTT. There was an immediate decrease of SAB due to CVAD since the implementation of The Strategy Plan (Figure 3).

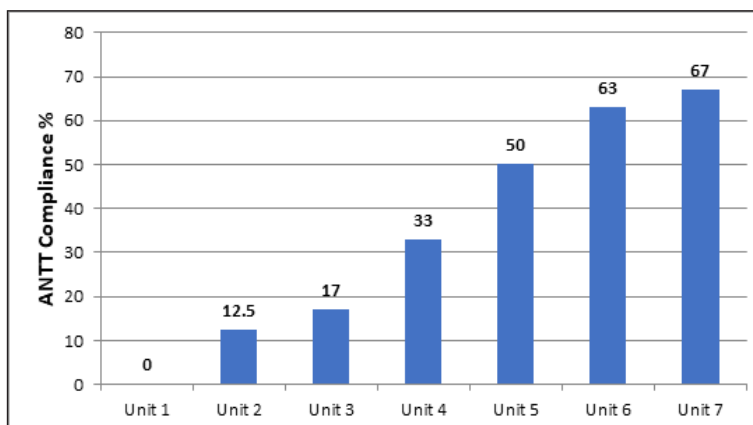


Figure 1. ANTT compliance by dialysis unit

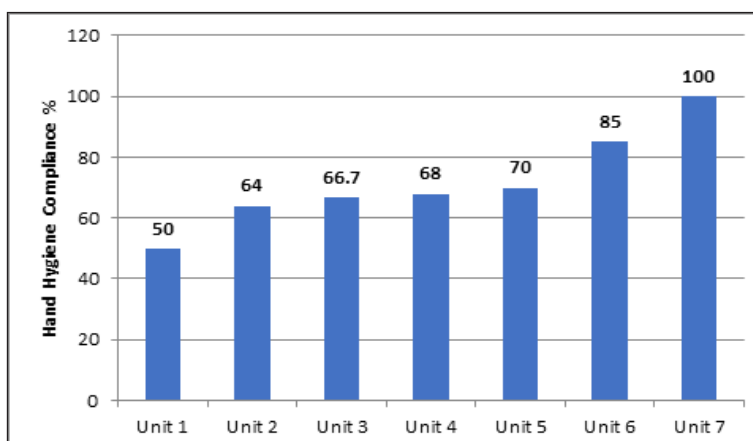


Figure 2. Hand hygiene compliance by dialysis unit

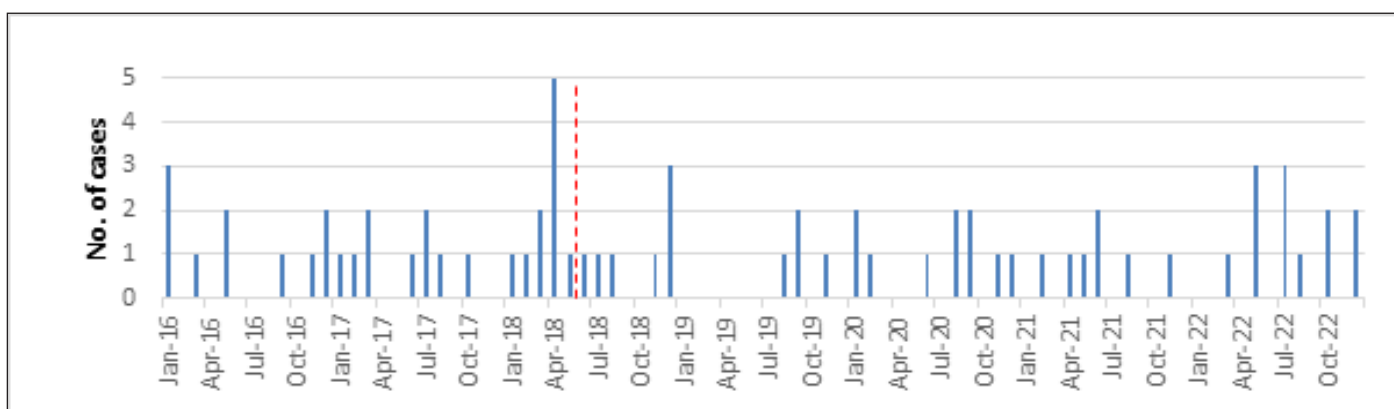


Figure 3. Number of HCA -SAB in the Renal Services, Jan 2016 – Dec 2022

Note: January- August 2019 – 0 infections in the Renal Services

---- red dotted line represents the time of intervention (implementation of renal ICP & AP)

There were no infections between the months of January 2019 to August 2019 (Figure 3). As this was a strategy, each time a SAB occurred after this, the Renal Vascular Access CNC would coordinate a huddle meeting by spending time at the facility and worked with the staff. It was noted that infection rates were often related to the introduction of new staff who had yet to complete education.

As the focus was on a strategy to decrease SABs and not only audit and compliance, SAB’s rate continued to remain significantly lower. Ownership of SABs and a focus on zero infections continued across the district. NUM’s of each facility focused on the positive result for patient care and undertook regular audits to ensure compliance. Renal nursing staff were accredited annually for CVAD dressing change and also connection and disconnection procedure.

4. Discussion

By implementing this Strategy Plan, It has demonstrated a significant reduction in the incidence of SAB associated with CVAD, improve patient outcomes, and enhance overall quality and safety of care (Sinclair et.al., 2022; Tong et.al., 2015). The key finding of our quality improvement project is that use of ANTT and hand hygiene has clearly been shown to reduce healthcare associated infections in haemodialysis settings (Scheithauer et al., 2012; Savithri et al., 2021).

This project has highlighted a few principles to follow: 1. Conduct a thorough assessment of current practices, of accessing and de-accessing CVAD, 2. Incorporate best practices for catheter insertion techniques, site care, dressing changes, and catheter maintenance, 3. Provide comprehensive education and training programs for healthcare staff involved in CVAD management, emphasizing the importance

of infection prevention measures, 4. Offer regular competency assessments and refresher training sessions to reinforce proper techniques and adherence to protocols, and, 5. Provide education and resources to patients and families on, advocating for proper CVAD care.

Strategies were achieved in this study from collaboration with the Infection Prevention and Control Unit, Cardiovascular Stream and Renal Service. Healthcare providers can work towards achieving the objectives, ensuring sustainability in caring for patients who require vascular access lines, both within healthcare facilities and in the home setting, while optimizing patient outcomes and resource utilization. Development of clinical practice guidelines and protocols, which serve as standardized recommendations for healthcare professionals. These guidelines help ensure consistency and quality of care across healthcare settings.

5. Conclusion

South Western Sydney Local Health District has a culture for zero SABs in our vulnerable dialysis community. The infection prevention strategies have proven successful in all dialysis units across the district. The focus was a strategy for implementation of best practice aseptic non-touch technique and hand hygiene, not purely audit and compliance results. As there has been no national or international best practice infection prevention principles published since 2003 for accessing CVAD, the aseptic non-touch technique in this paper could be adopted in other renal units nationally and internationally.

Limitation

This study has possible limitations of observational bias and cross-validating observations may help minimize the impact of these observational bias on study outcomes.

Future Research Studies

To further validate the benefit of ANTT, a larger, multi-centres cohort study could be conducted with define patient measurable outcomes. It would be helpful to capture a qualitative experience and perspective of the nurses who have been part of this quality improvement project, especially the new staff in the haemodialysis units to identify how to support their transition to practice in the haemodialysis unit. This could be followed by development of mandatory education for new staff prior to working in haemodialysis units to further prevent infections from occurring.

Implications for Clinical Practices

This project has highlighted the importance of education provided to staff, patients, and their carers. For example, the “training the trainer approach” and providing patients with a brochure “*Hand hygiene for safer dialysis*” are key success for this project. By increasing clinicians’ involvement and work collaboratively with other disciplines, it aims to improve patient outcomes. The general principles around best practice infection prevention control could be utilised in other speciality areas including (but are not limited to) cancer therapy centres, intensive care units and emergency departments.

Declaration of Conflicting Interests

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