



Right Asepsis with ANTT[®] for Infection Prevention

11

Stephen Rowley and Simon Clare

Abstract

Aseptic technique, which involves infection prevention actions designed to protect patients from infection when undergoing invasive clinical procedures, is universally prescribed by guideline makers as a critical competency in the prevention of infections. However, no meaningful explanation of what aseptic technique is or how it is to be applied to ensure patient safety is provided within any of the guidelines. The Aseptic Non Touch Technique (ANTT[®]), originated by Rowley in the late 1990s, was designed to help address variable aseptic technique standards of practice and provide a rationalized, contemporary, evidence-based framework to standardize this critical competency and help improve standards of practice. The ANTT[®] Clinical Practice Framework provides a comprehensive framework for aseptic technique for all invasive procedures based on an approach termed Key-Part and Key-Site Protection. During the insertion or manipulation of an intravascular device, the ‘ANTT-Approach’ provides a systematic method that supports the practitioner to include all the important elements of aseptic technique, with particular focus on the

identification and protection of ‘Key-Parts’ and ‘Key-Sites’ throughout the preparation and the procedure. This chapter provides clinical examples of how the ANTT[®] is implemented in the healthcare setting, as well as, importantly, how to promote compliance of the technique.

Keywords

Aseptic technique · ANTT[®] · Sterile · Aseptic

11.1 Which Aseptic Technique Is the ‘Right’ Aseptic Technique?

At its heart, aseptic technique involves a collection of infection prevention actions designed to protect patients from infection when undergoing invasive clinical procedures, including maintenance of indwelling medical devices. A combination of decontamination processes, sterilized equipment and handling technique is used to minimize potential transmission of pathogenic microorganisms (Clare and Rowley 2017). In terms of protecting patients from infection, aseptic technique is one of the most important and commonly used critical clinical competencies in healthcare. Although the prescription for aseptic technique is universal, agreement on the aim, definition, description and application of aseptic technique is not (Preston 2005; NICE 2012; Gorski et al. 2016).

S. Rowley (✉) · S. Clare
The Association for Safe Aseptic Practice (ASAP),
London, UK
e-mail: Stephen.rowley@antt.org;
simon.clare@antt.org

Historical and contemporary literature presents a confused hierarchy of terms and practices including sterile technique, aseptic technique, clean technique and non-touch technique, further compounded by interchangeable use and meaning (Aziz 2009; Rowley et al. 2010; Unsworth and Collins 2011). Internationally, it seems to have become 'fashionable' for guideline makers to address the historical confusion surrounding aseptic technique by simply prescribing the generic term 'aseptic technique', with virtually no meaningful explanation of what aseptic technique is or how it is to be applied to ensure patient safety (NICE 2012; Gorski et al. 2016; RCN 2016).

Such 'prescription without explanation' by major stakeholders appears to have undermined this critical clinical competency and potentially fuels the complacency associated with aseptic technique. In education, students and qualified staff are taught various educational concepts and practical methods of performing essentially the same activity using different methods and descriptors (Hartley 2005; Flores 2008; Aziz 2009; Rowley et al. 2010). But most concerning of all is the effect of a confused literature on clinical practice with poor standards of aseptic technique commonly and consistently reported (Hartley 2005; Flores 2008; Aziz 2009; Rowley et al. 2010; Unsworth and Collins 2011). As a result, concern for standards of aseptic technique has been reflected in a wide range of international initiatives concerned with improving infection prevention such as the Keystone project (Pronovost et al. 2006; Pronovost 2008), 5 Moments for Hand Hygiene (Sax et al. 2007), Saving Lives [UK] (DH 2007) and the 100,000 Lives Campaign [USA] (Berwick et al. 2006).

Given the significantly invasive nature of inserting indwelling medical devices and their ongoing care and maintenance, aseptic technique has always been of much concern in the field of intravenous therapy. However, despite this, historically and contemporaneously, the field of IV therapy fares no better in aseptic technique than any other field of clinical practice. Moreover, given the incidence of particularly high-profile organisms such as MRSA, IV therapy has consistently been identified as a particularly problematic area for aseptic technique.

Perhaps of most concern is that despite more than a century of infection prevention that has paralleled many advances in IV therapy, there is a dearth of evidence supporting which specific aseptic technique provides the most effective prevention against the risk of infection. For example, in a partial update to Clinical Guideline 2 (replaced by CG139), the National Institute for Health and Care Excellence (NICE) was unable to identify any clinical or cost-effectiveness evidence to recommend the best technique when handling vascular access devices to reduce infection-related bacteremia, phlebitis, compliance, MRSA or *C. diff* reduction and mortality (NICE 2012). Subsequently, NICE and other stakeholders have recognized ANTT[®] as providing the prerequisite platform required for guideline development and research enquiry in aseptic technique (NICE 2012 [updated 2017]).

Right Aseptic Technique: ANTT[®]

To avoid any ambiguity regarding aseptic technique as discussed above, all references to aseptic technique throughout this book are articulated using the practice terms and principles explicitly defined in the ANTT[®] Clinical Practice Framework.

ANTT[®] is the most commonly used aseptic technique framework in healthcare today and is rapidly evolving as a global standard. As a result, it is increasingly becoming the recognized standardized practice (NICE 2012), providing meaningful, accurate practice language. The development of ANTT[®] has been closely associated with IV practice as the insertion and use of IVs is the most commonly performed invasive procedure in healthcare. There are two types of ANTT[®]: Surgical-ANTT and Standard-ANTT (for context, Surgical-ANTT reflects the so-called sterile technique, and Standard-ANTT is a rationalized approach to better describing a multitude of ambiguous practice terms).

11.2 Aseptic Non Touch Technique (ANTT®)

Originated by Rowley in the late 1990s (2001), the Aseptic Non Touch Technique (ANTT®) Clinical Practice Framework was designed to help address variable and poor standards of practice and ambiguous theory by providing a rationalized, contemporary, evidence-based framework to standardize this critical competency and help improve standards of practice. Notably, ANTT® is a clinical practice standard for the complete spectrum of invasive clinical procedures, from major surgery to intravenous access, from intravenous maintenance to simple first aid activities. The National Institute for Health and Clinical Excellence (NICE) describes ANTT® as ‘a specific type of aseptic technique with a unique theory and practice framework’ (NICE 2012). The unique theory refers to the original educational and practice concept of ‘Key-Part and Key-Site Protection’. Used internationally in over 25 countries, ANTT® is now used frequently in the literature to describe aseptic technique practice and study and is commonly referenced or endorsed by international guidance including the *Australian Guidelines for the Prevention and Control of Infection in Healthcare* (NHMRC 2010), Public Health/NHS Wales (Welsh Government 2015), the National Institute for Health and Clinical Excellence (NICE 2012), the Health Protection Surveillance Centre Ireland (HPSC 2011) and the Infusion Nurses Society Infusion Therapy Standards of Practice (Gorski et al. 2016).

11.3 The ANTT® Clinical Practice Framework Explained

To address the historically confused and interchangeable use of terminology for aseptic technique, the ANTT® Clinical Practice Framework utilizes only achievable practice terms and accurately defines them as follows:

Aseptic—Free from pathogenic organisms (in sufficient numbers to cause infection)

Sterile—Free from (all) microorganisms

Clean—Free from visible marks and stains

Non-touch—The action of not touching critical or important parts of equipment and/or vulnerable or compromised parts of a patient

Often used interchangeably with the term ‘aseptic’ is the term ‘sterile’, a well-defined word that specifically means ‘an absence of *all* microorganisms’. Unfortunately, sterile is simply not achievable in typical healthcare settings due to the multitude of microorganisms in the air environment. The term ‘aseptic’ refers to an absence of pathogenic microorganisms in sufficient quantity to cause infection and *is* achievable in the typical healthcare setting. These terms should not be used interchangeably as they are *not synonymous*. The term ‘clean’ is defined as the absence of visible marks and stains and, for the obvious reason that microorganisms are not visible to the naked eye, offers no measurable or safe practice definition for invasive procedures. Non-touch technique (NTT) is not a free-standing aseptic technique as such but rather represents a critical component of any safe aseptic practice.

The practice terms in the ANTT® Practice Framework provide an interrelated set of definitions that are technically accurate, achievable and applicable to any invasive clinical procedure. Using these definitions has aided in the development of standardized competency-based education and training for both novices and experienced clinicians. These accurate descriptors of practice allow risk assessment to be simplified and focus on rational practice-based factors rather than arbitrary and subjective variables, so that clinical practice is more consistently applied.

11.4 ANTT®: Key-Part and Key-Site Protection

The ANTT® Practice Framework established that the aim of infection prevention during invasive procedures or the maintenance of indwelling medical devices by definition is and can be no more and no less than the procedure being ‘aseptic’. In ANTT®, maintaining an aseptic procedure is achieved by the fundamental concept and prac-

tical application of Key-Part and Key-Site Protection. The ‘Key-Parts’ of procedural equipment and the patients’ vulnerable points of access are portals of entry for bacteria. ‘Key-Parts’ and ‘Key-Sites’ are maintained in an aseptic state at all times during invasive procedures. Key-Part and Key-Site Protection is achieved by a practical process that involves prerequisite basic infective precautions such as hand cleaning and personal protective equipment (PPE), the use of sterilized equipment and medical supplies and an appropriate combination of aseptic fields and a non-touch handling technique.

Key-Sites—Areas of skin penetration that provide a direct route for the transmission of pathogens into the patient and present a significant infection risk. Key-Sites include surgical wounds, skin breakdowns or exit sites from CVAD/PVC placement.

Key-Parts—Critical parts of medical devices/items of procedure equipment that, if contaminated, provide a route for the transfer of harmful microorganisms directly onto or into a patient. In IV therapy, these include any part of the equipment that comes into direct or indirect contact with the liquid infusion.

11.5 Aseptic Fields

The type of aseptic fields utilized in an aseptic procedure is dependent upon the type of procedure and aseptic technique utilized. To this end, ANTT® defines the utilization of the three different types of aseptic fields in common practice:

Critical Aseptic Field—Usually a sterilized drape, used when a single main aseptic field is required to house and protect all procedure equipment that is typically removed from individual packaging onto the field. A main Critical Aseptic Field is used to help *ensure* equipment is maintained in an aseptic state during procedures by providing essential and primary protection from the procedure environment. Critical Aseptic Fields require what can be termed ‘critical management’



Fig. 11.1 Critical Aseptic Field (used with permission The Association for Safe Aseptic Practice – ASAP)

or the prohibition of anything non-sterilized entering the field at any time during the procedure. Subsequently, sterilized gloves are required to maintain asepsis while manipulating equipment into and out of the field. Essentially, all equipment is ‘handled’ as Key-Parts (Fig. 11.1).

General Aseptic Field—Typically a decontaminated and disinfected surface (examples include plastic procedure trays or dressing trolleys) or a single-use disposable product (examples include pulp paper or plastic trays). The main aseptic field that *promotes* asepsis during procedures by providing basic protection from the procedure environment. General Aseptic Fields are used when the procedure Key-Parts are easily and primarily protected using a type of Critical Field termed Micro Critical Aseptic Field (see below). General Aseptic Fields require ‘general’ rather than ‘critical’ management and are subsequently managed with non-sterilized gloves and non-touch technique (Fig. 11.2).

Micro Critical Aseptic Field (MCAF)—Examples include sterilized caps, covers and the inside of recently opened sterilized equipment packaging. Critical Aseptic Fields are used to protect Key-Parts individually, e.g. syringe cap or needle cover. They allow safe protection during less complex procedures while also affording a high level of cost-effective ANTT® (Fig. 11.2).



Fig. 11.2 General Aseptic Field with Micro Critical Aseptic Fields (used with permission The Association for Safe Aseptic Practice – ASAP)

11.6 Right Aseptic Technique: ANTT® Applied to IV Therapy

There are too many procedures and procedure variables to provide an exhaustive A–Z reference of ANTT® applied to IV therapy. Instead, the principles and practice terminology of the ANTT® Clinical Practice Framework have been outlined above, and broad examples of how the framework is applied to practice is outlined for four of the most common IV procedures below.

11.6.1 Right Aseptic Technique: ANTT® Applied to the Insertion of Central Venous Access Devices (CVAD)

11.6.1.1 Overview

The insertion of CVADs is a complex procedure with expert level of knowledge and competency-based skills required for safe and effective practice. Evidence-based consensus internationally supports insertion with a ‘central venous line care bundle’ and what has been termed ‘maximal [sterile] barrier precautions’ (O’Grady et al. 2011; Loveday et al. 2014; Gorski et al. 2016). Application of the ANTT® Risk Assessment supports this recommendation with central venous access always requiring Surgical-ANTT as explained below.

11.6.1.2 ANTT® Risk Assessment for CVAD Insertion

The process of ensuring asepsis (the absence of pathogenic organisms) during CVAD insertion is technically complex and involves having to protect numerous Key-Parts and one particularly large Key-Part, the CVAD itself. The procedure is highly invasive and may last an hour or more. These risk factors alone make it technically challenging to ensure asepsis throughout the procedure, and subsequently a Surgical-ANTT approach is required.

11.6.1.3 Basic Precautions for CVAD Insertion

Surgical-ANTT requires the practitioner to adopt a high level of precaution, such as a surgical hand scrub rather than a standard hand clean, and personal protective equipment (PPE) that includes the use of sterilized gloves, gowns, head wear and masks (Loveday et al. 2014).

Risk of airborne contamination at the bedside is reduced by ensuring the air environment has time to settle after any dust producing activities such as bed making or room cleaning prior to CVAD insertion.

11.6.1.4 Decontamination and Disinfection for CVAD Insertion

Most notably, Surgical-ANTT for CVAD insertion is typically performed using presterilized equipment and supplies and effective skin disinfection.

Skin disinfection starts with visibly clean skin prior to applying the antiseptic solution. Unless contraindicated,¹ the current evidence base supports the use of $\geq 0.5\%$ chlorhexidine in 70% IPA (Loveday et al. 2014; Gorski et al. 2016) applied with a suitable single-use applicator and a systematic technique that follows manufacturer’s recommendations. The disinfecting solution should be allowed to dry before insertion of a CVAD.

¹For chlorhexidine sensitivity, consider povidone-iodine in alcohol, and use chlorhexidine with caution in infants. Consider the lowest effective concentration of chlorhexidine for premature infants and infants under 2 months of age (O’Grady et al. 2011; Gorski et al. 2016). Observe for hypersensitivity reactions or possible allergic responses to chlorhexidine gluconate.

11.6.1.5 Aseptic Fields in CVAD Insertion

Using Surgical-ANTT for CVAD insertions requires a large enough working area covered by a sterilized drape(s) to safely contain and protect all procedure equipment as aseptic. Large equipment used inter-procedure, such as ultrasound, is also covered in sterilized covers that enable aseptic handling by the operator.

11.6.1.6 Non-touch Technique for CVAD Insertion

Critical Aseptic Fields used in Surgical-ANTT CVAD insertion are managed critically, with sterilized gloves used to maintain aseptic continuity when handling all equipment and supplies. Due to the complexity of the procedure, a completely non-touch technique is not and cannot be mandated. However, the effective practitioner will be mindful that sterilized gloves and drapes are not infallible and can be inadvertently contaminated. With this in mind, the principle remains that the safest way to not inadvertently contaminate a Key-Part is to not touch it directly where practically possible. To this end, many CVAD inserters pay particular reverence to the major Key-Part, the CVAD that will be inserted deep into the patient and lay indwelling, and only handle this part indirectly via forceps or sterilized packaging.

11.6.2 Right Aseptic Technique: ANTT® Applied to the Insertion of Peripheral Venous Catheter

11.6.2.1 Overview

The risks of peripheral venous catheter (PVC) insertion and maintenance have arguably been understated compared to CVAD placement (Zingg and Pittet 2009; Webster et al. 2013). The most recent point prevalence survey in the English National Health Service (NHS) noted the use of PVCs (outside of ICU) was 38.6% compared with CVAD use of 5.9% of patients surveyed (Hopkins et al. 2012). A 6-year epidemiological study by DeVries and Valentine (2016) highlighted the difference in approach to peripheral and central

venous management. Although PVCs naturally present less risk than CVADs, their considerably higher use resulted in similar numbers of bacteraemia. Frequent manipulations of PVCs by different healthcare workers demand effective aseptic technique and regularly documented surveillance of the device site, such as the Visual Infusion Phlebitis (VIP) scale (Gorski et al. 2011), for early detection of any complications.

11.6.2.2 ANTT® Risk Assessment for PVC Insertion

It should be noted that type of ANTT® for PVC insertion is particularly dependent upon the vessel health and vein accessibility of individual patients. As a result, the competency and experience of the practitioner are particularly relevant in the ANTT® Risk Assessment and may often direct the practitioner to the Surgical-ANTT technique.

However, due to the technical ease of achieving asepsis for a relatively few number of Key-Parts, ANTT® Risk assessment typically determines that PVC insertion can be performed safely by a competent practitioner using Standard-ANTT. To this end, non-sterile gloves are indicated if the access site is not touched following skin antiseptics (O'Grady et al. 2011).

11.6.2.3 Basic Precautions for PVC Insertion

PVC insertion demands effective hand hygiene and the use of appropriate PPE to help protect the healthcare worker from exposure to blood-borne pathogens. Recommended PPE varies internationally. The most common PPE guidelines involve non-sterile or sterile glove usage depending upon the type of ANTT® utilized. In addition, disposable aprons are recommended in Epic3, but not universally. Loveday et al., through systematic review, identify a developing evidence base identifying a steady build-up of microorganisms on staff uniforms with some association to healthcare-associated infections (HAI) (Loveday et al. 2014).

All invasive procedures require appraisal of the aseptic technique integrity throughout the procedure. This principle is particularly relevant

in PVC insertion as it can often be necessary to re-palpate the injection site. If performing Standard-ANTT, vein re-palpation requires recleaning of the puncture site; if vein detection continues to be problematic and it is not practical to reclean the skin after re-palpation, sterilized gloves should be introduced. If performing Surgical-ANTT and there is a need to insert the PVC immediately after re-palpation without recleaning the skin, the practitioner must consider the integrity of their sterilized gloves prior to proceeding and replace them if compromised.

11.6.2.4 Decontamination and Protection for PVC Insertion

If using a reusable procedure tray, the tray should be decontaminated and disinfected according to local policy pre- and post-procedure.

Prior to insertion, the skin, or Key-Site, should be cleaned and disinfected using a non-touch technique with a single-use applicator licensed for purpose. Solution should be applied with a frictional cross-hatch method using pressure to reach deep into the skin layers. The skin must be allowed to dry prior to insertion. If re-palpation is necessary, the site should be recleaned and managed as described above.

11.6.2.5 Aseptic Fields in PVC Insertion

PVC insertion using Standard-ANTT involves Key-Parts being primarily protected individually with Micro Critical Aseptic Fields such as sterilized caps and covers and the inside of sterilized equipment packaging. Secondary aseptic field protection is provided by containing all procedure equipment within a procedure tray serving as a General Aseptic Field.

Disposable trays used as General Aseptic Fields for PVC insertion should be large enough to provide a reasonable working area with high sides to contain spillage of liquids or sharps.

A sterilized drape may be considered for placement underneath the patient's arm to promote asepsis around the immediate procedure environment as well as to help contain any leakage of blood.

If Surgical-ANTT is selected for PIV insertion, full barrier precautions are not recommended by evidence-based guidance; however, there is consensus-based guidance suggesting an increased attention to skin disinfection and the use of sterilized gloves might be beneficial in the context of longer indwelling times for PVCs (Gorski et al. 2016). A modest-sized sterilized drape, large enough to cover a small treatment trolley or procedure tray, can adequately serve as a Critical Aseptic Field with sterilized gloves worn for all equipment handling.

11.6.2.6 Non-touch Technique for PVC Insertion

When using Standard-ANTT, non-touch technique for PVC equipment preparation and insertion is mandatory and technically straightforward. As already noted, asepsis of the Key-Site is compromised when the Key-Site requires re-palpation after skin disinfection. See above for the appropriate counter measures.

11.6.3 Right Aseptic Technique: ANTT[®] Applied to Intravenous Maintenance

11.6.3.1 Overview

The term intravenous maintenance is used below to describe the preparation and administration of intravenous drugs via infusion or injection. Any type of intravenous device, whether central or peripheral access, provides a portal of entry for microorganisms with a significant risk of infection. This risk is compounded by the frequency in which IV devices are handled and manipulated by many different and busy healthcare workers over long periods of time. Effective aseptic technique on every manipulation is of paramount importance. Although the risk of infection is significant, establishing and maintaining asepsis when connecting intravenous infusions or administering intravenous injections is not technically challenging and can warrant a relatively simple and efficient approach to aseptic technique.

11.6.3.2 ANTT® Risk Assessment for IV Maintenance

Standard-ANTT is most likely selected for IV maintenance on the basis that procedures are typically of short duration and will involve minimal numbers of small Key-Parts that are technically easy to protect with non-touch technique and individual Micro Critical Aseptic Fields. The risks of the invasive nature of an IV device can be reduced by the utilization of closed intravenous line systems (Graves et al. 2011).

11.6.3.3 Basic Precautions for IV Maintenance

In preparation for Standard-ANTT, the practitioner begins by performing important precautions such as hand cleaning and applying personal protective equipment (PPE) according to local policy. Given the volume and frequency of IV maintenance, the challenge for healthcare organizations is ensuring compliance with basic precautions, especially effective hand cleaning every time staff connect or access intravenous systems.

11.6.3.4 Decontamination and Protection for IV Maintenance

The most common aspects of decontamination for Standard-ANTT for IV maintenance are decontamination and disinfection of procedure trays / trolleys / surfaces and, particularly, disinfection of IV hubs.

11.6.4 Procedure Tray Disinfection

Due to a highly variable evidence base for this area of practice (Leas et al. 2015), there is a wide choice of disinfection wipes available. It is important that local policies be explicit regarding the expectancy for decontamination, disinfection, storage and usage of procedure trays.

Given that procedure trays are utilized to promote asepsis and not ensure it, pulp or paper trays can be acceptable; however, such trays should be large enough to serve as a General Aseptic Field and large enough to promote Key-Part protection, enable safe transport and handling of equipment

as well as have sides high enough to contain any spillage of liquids or sharps. A clear, single system for safe storage of disposable trays is important as they cannot be decontaminated or disinfected prior to use.

Post-procedure decontamination and disinfection are important in preventing the potential for cross infection. Reusable medical equipment must not be stored without cleaning or while still wet to inhibit microorganism clustering and biofilm development while providing maximal effectiveness of the disinfection solution (NPSA 2009; HIRL 2006).

11.6.5 IV Hub Disinfection

When not in use, IV hubs are likely to come into contact with microorganisms from the patient or immediate environment. There is a strong and developing evidence base describing effective technique for disinfection of the IV hubs (Hibbard 2005; Kaler and Chinn 2007; Moureau and Flynn 2015; Gorski et al. 2016). It is widely accepted that best technique requires alcohol and chlorhexidine disinfection and adequate time spent ‘scrubbing’ the hub, creating friction (Kaler and Chinn 2007; Smith et al. 2012). Guidance still varies slightly concerning the type of disinfectant and the duration of scrubbing (Table 11.1). To this end, the user should be guided by local policy.

11.6.6 Passive IV Hub Disinfection

There is a growing body of evidence indicating that effective and routine IV hub disinfection is not universally achieved and that failure in hub disinfection is common (Moureau and Flynn 2015). To help address such ‘human factors’, so-called passive disinfection has been recommended as an alternative for effective and reliable IV hub disinfection (Gorski et al. 2016).

11.6.6.1 Aseptic Fields in IV Maintenance

Aseptic fields have a pivotal role in Key-Part protection, and typically, using Standard-ANTT for IV maintenance, Key-Parts are afforded primary

Table 11.1 Recommended hub disinfectant time and techniques per guidance documents

	Disinfectant	Time	Technique
Epic3 (Loveday et al. 2014)	• 2% CHG/70% IPA	≥15 s	Clean + allow to dry (follow manufacturer's recommendations)
CDC (O'Grady et al. 2011)	• >0.5% CHG/70% IPA • 70% IPA • Povidone-iodine	No recommendation	'Scrubbing'
INS (Gorski et al. 2016)	• >0.5% CHG/70% IPA • 70% IPA • Povidone-iodine	Various reported (i.e. between 5 and 60 s)	Vigorous mechanical scrubbing and allow to dry (follow manufacturer's recommendations)

protection by Micro Critical Aseptic Fields such as sterilized caps. For non-toxic medications, the sterilized inside of a syringe packet is also widely used for protecting syringe tip Key-Parts as they provide excellent Key-Part Protection and have the added advantage of positioning operator hands well away from the Key-Part. Secondary protection is typically provided by a plastic or disposable tray promoting asepsis, thus serving as a General Aseptic Field.

11.6.6.2 Non-touch Technique for IV Maintenance

IV maintenance typically involves technically simple non-touch technique of a few Key-Parts such as the connecting of a syringe to a needle-free connector. However technically simple, meticulous non-touch technique is paramount and mandatory. If compromised, equipment must be discarded or re-disinfected. Key-Parts should be assembled one at a time and immediately protected when not in use with individual Micro Critical Aseptic Fields such as sterilized caps and covers.

11.6.7 Right Aseptic Technique: ANTT® Applied to Central Line Dressing Change

11.6.7.1 Overview

Dressing changes are not necessarily invasive but do involve significant risk of infecting a patient through the transmission of harmful microorganisms (Ullman et al. 2015). Protecting a CVAD entry site requires ongoing Key-Site Protection involving CVAD dressings and site cleaning.

11.6.7.2 CVAD Dressings

Based on evidence, there is consensus across international guidance for the use of semipermeable clear dressings with integral or separate chlorhexidine and fixation (Loveday et al. 2014; Gorski et al. 2016). It should be noted that ANTT® considers the skin area beneath an intact aseptic dressing to be the Key-Site, not just the much smaller exit site.

Skin antisepsis is carried out during a dressing change using best practice guidance:

Use a single-use application of a solution of >0.5% chlorhexidine gluconate in 70% isopropyl alcohol (or povidone-iodine in alcohol for patients with sensitivity to chlorhexidine) to clean the CVAD insertion site during dressing changes, and allow to air dry (Loveday et al. 2014; Gorski et al. 2016).

11.6.7.3 ANTT® Risk Assessment for CVAD Dressing Change

The technical difficulty of maintaining asepsis during CVAD dressing change and the subsequent type of ANTT® utilized is largely dependent on the type and combination of medical supplies used. Complete and subsequently more complex CVAD dressing changes typically require Surgical-ANTT as there are a number of Key-Parts and a large Key-Site to manage aseptically: an old and new dressing, fixation devices that vary in handling complexity and a chlorhexidine disk if not integral to the dressing.

11.6.7.4 Basic Precautions for CVAD Dressing Change

Effective hand hygiene is followed by application of appropriate PPE such as aprons/protective

gowns and gloves depending on the type of ANTT® used. Where Surgical-ANTT is utilized, non-sterile gloves can be used for dressing removal, and sterilized gloves are utilized thereafter.

11.6.7.5 Aseptic Fields in CVAD Dressing Change

Because CVAD dressing changes in many countries include sterile changes with CHG protective sponge and/or fixation devices, they require Surgical-ANTT, and thus application of the main Critical Aseptic Field with all the Key-Parts protected upon it would apply (Gorski et al. 2016).

11.6.7.6 Non-touch Technique for CVAD Dressing Change

When using Standard-ANTT and Micro Critical Aseptic Fields, the practitioner must be conscious throughout that maintaining asepsis depends on effective non-touch handling of Key-Parts and the Key-Site at all times.

Non-touch handling is promoted when skin cleaning is performed by using a purpose built and licensed applicator designed to keep the healthcare worker's fingers well away from the Key-Site.

Perhaps often forgotten, dressings should be removed with as much handling care as when applied. Carefully rolling the dressing up from the edges of the dressing is one such method of effective, controlled removal. As well as helping to prevent Key-Site contamination through non-touch technique, such care helps minimize the risks of adhesive-related skin injury. Application of a skin barrier solution may help reduce the risk of skin damage (Gorski et al. 2016).

11.6.7.7 Decontamination for CVAD Dressing Change

Skin antisepsis following existing dressing removal should be performed using evidence-based recommendations. Preferred disinfection, if not contraindicated*¹, is an alcoholic solution with >0.5% CHG (Gorski et al. 2016) in a single-use applicator (Loveday et al. 2014). The skin should be cleaned as per manufacturer's recommendations such as a firm cross-hatch technique

(Moureau 2003) with a minimum cleaning time of 30 s (Gorski et al. 2016). For the cleaning solution to provide its most effective bacterial kill effect, it must be allowed to dry fully before a dressing is applied.

Efficacy has not been sufficiently demonstrated for the use of topical antimicrobial ointments (Loveday et al. 2014); however, the use of chlorhexidine-impregnated dressings or impregnated sponges is recommended (NICE 2012, 2015; Gorski et al. 2016).

11.7 ANTT® Clinical Governance: Competency, Compliance and Surveillance

Achieving and maintaining the effective delivery of ANTT® for every patient during every invasive interaction across large healthcare organizations naturally require a robust effective clinical governance framework that reflects the critical importance of effective ANTT® to patient outcome. Effective governance should include:

- Clear responsibilities and accountabilities
- A robust implementation program
- Clear expectations communicated to staff through policy and guidelines
- Standardized education and training
- Competency assessment
- Infection surveillance of relevant indicators
- Compliance audit

11.7.1 Competency

The Infusion Nurses Society describes competency for infusion therapy as something that '... goes beyond psychomotor skills and includes application of knowledge, critical thinking, and decision-making abilities' (Gorski et al. 2016). Similarly, ANTT® competency assessment includes assessment of theory and practice. The standard competency assessment tool for Surgical-ANTT and Standard-ANTT requires demonstration of effective Key-Part and Key-Site Protection but also the articulation of ANTT®

terms and principles. The inclusion of theory in a practical assessment helps organizations embed a common practice language for this important competency that has the additional benefit of being used internationally—helping generate more meaningful discussion about this critical competency (ANTT® Competency Assessment Tools are freely available from www.antt.org/competency assessment).

11.7.2 Implementation

ANTT® is typically implemented across health-care organizations as a quality assurance-based audit cycle (Fig. 11.3) involving a suite of targeted resources and implementation tools. The standardization of clinical practice is further aided by a series of visual, risk-assessed and sequenced clinical practice guidelines (Fig. 11.4). These simple and adaptable guidelines communicate a wealth of practical information in a bite-sized user-friendly package. Translated into multiple languages, the ANTT® Clinical Practice Guidelines are the visual embodiment of the Clinical Practice Framework.

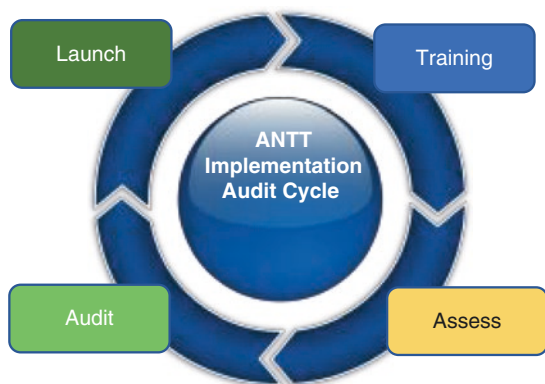
Effective implementation of any important clinical competency is dependent upon various organizational factors (Melle et al. 2017).

Evaluation of ANTT® implementation across seven large hospitals identified executive board-level organizational support as a key indicator for effective implementation (Rowley et al. 2010). A recently published study looked at the essential elements of the ANTT-Approach 36 months after implementation and demonstrated significantly improved practice with best practice elements of aseptic technique (Clare and Rowley 2017).

11.7.3 Compliance

Just like any other critical clinical competency, once ANTT® has been established across an organization, it is necessary to maintain practice standards. Again, like any clinical competency, this is not an easy task and is best not underestimated. For perspective, despite huge investments of time and money in hand hygiene practice, compliance internationally is commonly reported at approximately ≤50% (Fuller et al. 2011; Kingston et al. 2015; Brühwasser et al. 2016). Soberingly, effective aseptic technique requires staff compliance with an additional of four or five essential key practice components.

ANTT® addresses this compliance challenge with a multifactorial approach including:



Phase	Suggested Resources
	(Freely available from www.antt.org)
Pre/Post Audit	The ANTT® Audit of Invasive Clinical Procedures The ANTT® Clinical Audit Tool(s)
Launch	Board level communication to all relevant staff
Training	ANTT Clinical Practice Framework ANTT Guidelines
Assess	The ANTT® Competency Assessment Tool (CAT)

Fig. 11.3 ANTT® audit cycle (used with permission The Association for Safe Aseptic Practice – ASAP)



Fig. 11.4 ANTT® procedure guidelines (used with permission The Association for Safe Aseptic Practice – ASAP)

- Periodic assessment of ANTT® competency
- Simple but explicit picture-based ANTT® Guidelines visible in relevant practice areas to help make expectations explicit and measurable
- Surveillance—see below

11.7.3.1 Surveillance of Practice

Periodic ‘snapshot’ audit of various locations within a hospital can be an effective way of monitoring practice standards and informing the regularity of ANTT® competency reassessment.

11.7.3.2 Surveillance of Outcomes

It is important that healthcare organizations monitor for signs of poor standards of ANTT® by surveillance of relevant infective organisms. Point prevalence surveys (PPS) clearly demonstrate successes in reducing targeted organisms (Hopkins et al. 2012); however, they also illus-

trate the risks of only focusing on several high-profile harmful microorganisms and losing sight of the larger issue of the mechanisms and processes of infection prevention that help drive reductions in HAI across the board. In the most recently reported English NHS PPS from 2012, it was clear that the high-profile national targeting of MRSA bacteremia had reduced incidence considerably; however, it was also clear that other resistant organisms increased in prevalence (Hopkins et al. 2012).

Effective surveillance has highlighted the risks of not considering PVCs and CVADs as equally important in the context of healthcare-associated infections (DeVries and Valentine 2016), and the successful monitoring of the application of targeted resources is yielding improved outcomes (DeVries et al. 2016) along with a better understanding of adherence to best practice guidelines (Yagnik et al. 2017).

11.7.4 Developing a Meaningful Evidence Base for Aseptic Technique

As previously discussed, the pre-ANTT[®] evidence base for aseptic technique was weak and lacking in robust studies to define and describe practice. Since the development of ANTT[®], a more robust, standardized and generalizable evidence base is beginning to develop as more countries and healthcare organizations implement a single practice standard for aseptic practice. Research generation provides a better and more complete evidence base for aseptic technique, and ANTT[®] is providing the framework for much of this development (Beaumont et al. 2016; Flynn et al. 2015).

The Association for Safe Aseptic Practice (ASAP) is a not-for-profit, non-governmental organization (NGO) based in the United Kingdom (UK) that promotes and administrates the ANTT[®] project. Using an epidemiological approach, the association produces standardized surveillance tools to assist in data collection, analysis and dissemination of ANTT[®] implementation and maintenance. A standard research protocol template aids in the design and implementation of local research studies helping to further develop a global evidence base for aseptic technique. It should be noted that ANTT[®] is trademarked to prevent variable alteration of the framework and standard approach. Utilization of ANTT[®] is very much encouraged and supported (see www.antt.org)!

Case Study

Nurse Smith was responsible for infection prevention at the hospital. As part of her objectives for the year, she identified aseptic practices with intravenous devices as a focus.

The first step in her initiative was to observe and document practices within the hospital (a pre-audit phase). After pinpointing gaps, confusion and compliance issues with aseptic technique, Nurse Smith con-

tacted The-ASAP for advice and resources. Working collaboratively with The-ASAP/ANTT[®] Team she developed simple one-page educational sheets that emphasized the key points of the Aseptic Non Touch Technique (ANTT[®]). Nurse Smith, using a mixture of standardized ASAP and locally developed ANTT[®] resources, created a local multimodal form of education to roll out the key points.

- The education summary pages were used in department/unit huddles with a 5-min session of training with one page of the education per week.
- Posters were set up in locations around each unit, and observers were recruited to watch for opportunities to stimulate question and answer quick sessions with the nurses.
- ANTT[®] (visual) Clinical Practice Guidelines were deployed in clinical areas as education and training aids.
- Throughout the 3-month period, educational lectures from visiting clinicians were given to all the medical and nursing staff emphasizing the use of ANTT[®].
- The ANTT-Approach was written into local policy and procedure documents, explicitly creating the expectation of standard aseptic practice.
- Nurse Smith used standardized assessment forms to competency assess clinical staff in ANTT[®].

Follow-up observations and documentation revealed an 80% improvement in specific key points and practices of ANTT[®] and aseptic management of intravenous devices.

A long-term plan was developed to conduct periodic observation, using a checklist of key points and practices consistent with hospital policy, and to integrate annual aseptic education into the computer-based training already used for staff education.

Summary of Key Points

1. Aseptic technique involves a collection of infection prevention actions designed to protect patients from infection when undergoing invasive clinical procedures, including maintenance of indwelling medical devices.
2. The Aseptic Non Touch Technique (ANTT[®]) Clinical Practice Framework is quickly becoming the international standard when referring to aseptic technique.
3. The ANTT[®] Clinical Practice Framework utilizes only achievable practice terms and defines them as follows:
 - (a) **Aseptic**—Free from pathogenic organisms (in sufficient numbers to cause infection)
 - (b) **Sterile**—Free from (all) microorganisms (not possible in aseptic technique)
 - (c) **Clean**—Free from visible marks and stains (useful for cleaning, but not an aim for aseptic technique)
 - (d) **Non-touch**—The action of not touching critical or important parts of equipment and/or vulnerable or compromised parts of a patient
4. ANTT[®] focuses on a fundamental concept of Key-Part and Key-Site Protection to maintain an aseptic procedure.
5. The effectiveness of the ANTT[®] model has been demonstrated, but like any critical competency, its effectiveness depends on adherence to its principles and process by clinicians involved in inserting or manipulating/maintaining intravenous devices.
6. Compliance of ANTT[®] is enhanced through:
 - (a) Periodic assessment of ANTT[®] competency

- (b) Picture-based ANTT[®] Guidelines visible in relevant practice areas to provide explicit and measurable expectations
- (c) Education, training and surveillance

Endorsement The Association for Safe Aseptic Practice (The-ASAP) oversees the development and dissemination of Aseptic Non Touch Technique (ANTT) intended for all invasive procedures and maintenance of invasive devices. Now used in over 30 countries and expanding, ANTT is the de facto international standard for aseptic technique. As editor, Nancy Moureau had the foresight to ensure that this contemporary book didn't articulate important matters of aseptic technique in historically variable terminology. Instead, the ANTT Practice Framework is defined comprehensively and used throughout. The-ASAP supports all healthcare organizations on matters of ANTT practice and implementation (www.antt.org).



References

- Aziz AM. Variations in aseptic technique and implications for infection control. *Br J Nurs*. 2009;18(1):26–31.
- Beaumont K, Wyland M, Lee D. A multi-disciplinary approach to ANTT implementation: what can be achieved in 6 months. *Infect Dis Health*. 2016;21:67–71.
- Berwick DM, Calkins DR, McCannon CJ, Hackbarth AD. The 100,000 lives campaign: setting a goal and a deadline for improving health care quality. *JAMA*. 2006;295(3):324–7.
- Brühwasser C, Hinterberger G, Mutschlechner W, Kaltseis J, Lass-Flörl C, Mayr A. A point prevalence survey on hand hygiene, with a special focus on *Candida* species. *Am J Infect Control*. 2016;44:71–3.

- Clare S, Rowley S. Implementing the Aseptic Non Touch Technique (ANTT[®]) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. *J Infect Prev.* 2017;19(1):6–15. Available: <http://journals.sagepub.com/doi/abs/10.1177/1757177417720996> (accessed: September 2017).
- DeVries M, Valentine M. Bloodstream infections from peripheral lines: an underrated risk. *American Nurse Today.* (2016);11(1) <https://www.americannursetoday.com/piv/>. Accessed Sept 2017.
- DeVries M, Valentine M, Mancos P. Protected clinical indication of peripheral intravenous lines: successful implementation. *J Assoc Vasc Access.* 2016;21:89–92.
- DH. Department of Health, saving lives: reducing infection, delivering clean and safe care. 2007. http://webarchive.nationalarchives.gov.uk/+http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_078134. Accessed Sept 2017.
- Flores A. Sterile versus non-sterile glove use and aseptic technique. *Nurs Stand.* 2008;23:35–9.
- Flynn JM, Keogh SJ, Gavin NC. Sterile vs aseptic non-touch technique for needle-less connector care on central venous access devices in a bone marrow transplant population: a comparative study. *Eur J Oncol Nurs.* 2015;19:694–700.
- Fuller C, Savage J, Besser S, Hayward A, Cookson B, Cooper B, Stone S. “The dirty hand in the latex glove”: a study of hand hygiene compliance when gloves are worn. *Infect Control Hosp Epidemiol.* 2011;32(12):1194–9.
- Gorski L, Eddins J, INS. Infusion nursing standards of practice. *JIN Suppl.* 2011;34(1S):S1–110.
- Gorski LA, Hadaway L, Hagle M, McGoldrick M, Orr M, Doellman D. Infusion therapy standards of practice. *J Infus Nurs.* 2016;39(Suppl 1):S1–S159.
- Graves N, Barnett AG, Rosenthal VD. Open versus closed IV infusion systems: a state based model to predict risk of catheter associated blood stream infections. *BMJ Open.* 2011;1(2):e000188.
- Hartley J. Aseptic technique to be part of essence of care guidance. *Nurs Times.* 2005;101:6.
- Hibbard JS. Analyses comparing the antimicrobial activity and safety of current antiseptic agents: a review. *J Infus Nurs.* 2005;28:194–207.
- HIRL. Bactericidal efficacy tests (EN1276) phase 2, step 1—Sani-Cloth[®] 7. Disposable disinfectant wipes for medical devices (PDI[®]). Hospital Infection Research Laboratory; 2006.
- Hopkins S, Shaw K, Simpson L. English National Point Prevalence Survey on healthcare-associated infections and antimicrobial use. Health Protection Agency. 2012. http://webarchive.nationalarchives.gov.uk/20140714095446/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317134304594. Accessed Sept 2017
- HPSC. Health Protection Surveillance Centre: guidelines for the prevention of catheter-associated urinary tract infection. 2011. <https://www.hpsc.ie/a-z/microbiologyantimicrobialresistance/infectioncontrolandhai/guidelines/File,12913,en.pdf>. Accessed Sept 2017.
- Kaler W, Chinn R. A matter of time and friction. *J Assoc Vasc Access.* 2007;12(3):140–2.
- Kingston L, O’Connell NH, Dunne CP. Hand hygiene-related clinical trials reported since 2010: a systematic review. *J Hosp Infect.* 2015;92(4):309–20.
- Leas BF, Sullivan N, Han JH, et al. Environmental cleaning for the prevention of healthcare-associated infections [Internet]. Rockville: Agency for Healthcare Research and Quality (US); 2015. Technical briefs no 22. <https://www.ncbi.nlm.nih.gov/books/NBK316174/>. Accessed Sept 2017
- Loveday HP, Wilson JA, Pratt RJ, Golsorkhi M, Tingle A, Bak A, Browne Prieto J, Wilcox M. epic3: national evidence-based guidelines for preventing healthcare-associated infections in NHS Hospitals in England. *J Hosp Infect.* 2014;86(S1):S1–S70.
- Melle EV, Gruppen L, Holmboe ES, Flynn L, Oandasan I, Frank JR, for the International Competency-Based Medical Education Collaborators Academic Medicine. Using contribution analysis to evaluate competency-based medical education programs: it’s all about rigor in thinking. *Acad Med.* 2017;92(6):752–8.
- Moureaux NL. Is your skin-prep technique up-to-date? *Nursing.* 2003;33(11):17.
- Moureaux NL, Flynn J. Disinfection of needleless connector hubs: clinical evidence systematic review. *Nurs Res Pract.* 2015;2015:1–20.
- National Health and Medical Research Council. Australian Commission on Safety and Quality in Healthcare: Australian Guidelines for the Prevention and Control of Infection in Healthcare Commonwealth of Australia. 2010. https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/cd33_infection_control_healthcare_140616.pdf. Accessed Nov 2015.
- NICE. Clinical guideline 139—healthcare-associated infections: prevention and control in primary and community care. 2012. <https://www.nice.org.uk/guidance/cg139/evidence/control-full-guideline-pdf-185186701>. Accessed Sept 2017.
- NICE. The 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites. 2015. <https://www.nice.org.uk/guidance/mtg25>. Accessed Sept 2017.
- NPSA. National Patient Safety Agency: the revised healthcare cleaning manual. 2009. <http://www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=61814>. Accessed Sept 2017.
- O’Grady NP, Alexander M, Burns LA, Dellinger EP, Garland J, O’Heard S, Lipsett PA, Mansur H, Mermel LA, Pearson ML, Raad II, Randolph A, Rupp ME, Saint S, The Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections. 2011. <https://www.cdc.gov/hai/pdfs/bsi-guidelines-2011.pdf>. Accessed Sept 2017.
- Preston R. Aseptic technique: evidence-based approach for patient safety. *Br J Nurs.* 2005;14(10):540–6.
- Pronovost P. Interventions to decrease catheter-related bloodstream infections in the ICU: the Keystone

- Intensive Care Unit Project. *Am J Infect Control*. 2008;36(10):S171.e1–5.
- Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, Sexton B, Hyzy R, Welsh R, Roth G, Bander J, Kepros J, Goeschel C. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med*. 2006;355:2725–32.
- RCN. Royal College of Nursing: standards for infusion therapy. 4th ed. 2016. <https://www.rcn.org.uk/professional-development/publications/pub-005704>. Accessed Sept 2017.
- Rowley S. Theory to practice: aseptic non-touch technique. *Nurs Times*. 2001;97:VI–VIII.
- Rowley S, Clare S, Macqueen S, Molyneux R. ANTT v2: an updated practice framework for aseptic technique. *Br J Nurs*. 2010;19(5):S5–S11.
- Sax H, Allegranzi B, Uckay I, Larson E, Boyce J, Pittet D. ‘My five moments for hand hygiene’: a user-centred design approach to understand, train, monitor and report hand hygiene. *J Hosp Infect*. 2007;67:9–21.
- Smith J, Irwin G, Viney M, Watkins L, Morris S, Kirksey K, Brown A. Optimal disinfection times for needleless intravenous connectors. *J Assoc Vasc Access*. 2012;17:137–43.
- Ullman AJ, Cooke ML, Mitchell M, Lin F, New K, Long DA, Mihala G, Rickard CM. Dressings and securement devices for central venous catheters (CVC). *Cochrane Database Syst Rev*. 2015;(9). Art. No.: CD010367. <https://doi.org/10.1002/14651858.CD010367.pub2>.
- Unsworth J, Collins J. Performing an aseptic technique in a community setting: fact or fiction? *Prim Health Care Res Dev*. 2011;12:42–51.
- Webster J, Osborne S, Rickard CM, New K. Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database Syst Rev*. 2013;(4). Art. No.: CD007798. <https://doi.org/10.1002/14651858.CD007798.pub3>.
- Welsh Government. Welsh health circular. WHC/2015/026. 2015. <http://www.primarycareservices.wales.nhs.uk/sitesplus/documents/1150/WHC%202015.026.pdf>.
- Yagnik L, Graves A, Thong K. Plastic in patient study: prospective audit of adherence to peripheral intravenous cannula monitoring and documentation guidelines, with the aim of reducing future rates of intravenous cannula-related complications. *Am J Infect Control*. 2017;54:34–8.
- Zingg W, Pittet D. Peripheral venous catheters: an under-evaluated problem. *Int J Antimicrob Agents*. 2009;34(4):S38–42.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

