Hair Removal Methods

REDUCING THE RISK OF HEALTHCARE-ASSOCIATED INFECTIONS

by Maret Millard, NREMT-B, and J. J. Hedden, BA

Objectives

After completion of this self study activity, the learner will be able to:

1. Identify, compare and contrast the methods of hair removal for a surgical operation.

2. Rank the hair removal methods according to contributing risk for a healthcare-associated infection (HAI).

3. Identify the best practice in hair removal (e.g., time, place and method of hair removal) from a surgical patient to reduce the risk of a surgical site infection.

4. Describe different methods of implementing hair removal best practices in your institution based on The Institute for Healthcare Improvement (IHI) Model for Improvement.

Test Questions

Circle the correct answer.

1. Hair removal by shaving has been identified as a culprit for increased surgical site infections.
   a) True
   b) False

2. Studies indicate that infection rates are lowest in patients who did not require hair removal as compared to patients who were shaved.
   a) True
   b) False

3. Hair must be removed when it might:
   a) Interfere with the incision
   b) Interfere with the adhesion of incise drapes, patient plates or grounding pads, or monitoring electrodes
   c) Compromise the adhesion of postoperative dressings
   d) All of the above

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Managing Infection Control and 3M Health Care will be working collaboratively to provide continuing education courses in monthly editions of Managing Infection Control.
4. Shaving causes nicks and cuts which are portals of entry for bacteria, and increase the risk of postoperative wound infection.
   a) True
   b) False

5. Which combination of time/method contributes to the lowest surgical site infection rate?
   a) Razor the morning of surgery
   b) Clippers the morning of surgery
   c) Razors the night before surgery
   d) Clippers the night before surgery

6. Which of the following is a drawback to using depilatories?
   a) Patient objections
   b) Time consuming and messy to apply
   c) Requires pre-testing of patient for sensitivity before surgery
   d) All of the above

7. Surgical site infection rates are affected by the time element related to hair removal. The lowest risk for infection is attributed to which time?
   a) Hair removal more than 24 hours before surgery
   b) Hair removal 24 hours before surgery
   c) Hair removal the morning of surgery
   d) Hair removal the night before surgery

8. Most healthcare-associated infections (HAIs) can not be prevented by successful recommended preventive practices.
   a) True
   b) False

9. The Institute for Healthcare Improvement (IHI) recognizes that shaving the operative site has demonstrated the ability to affect the risk of SSI.
   a) True
   b) False

10. The key elements of the Model for Improvement to create new and safer systems for surgical site infections are:
    a) Form a team and set aims
    b) Establish measures
    c) Select and test changes
    d) All of the above

**Introduction**

There are many factors that expose patients to increased risk for surgical site infection (SSI). In this article we will be focusing on hair removal methods as an important factor to consider when looking at an overall approach to reduce the incidence of SSI. The information will be presented in such a way that we as healthcare practitioners can observe the evidence within a framework that takes into account the larger category of healthcare-associated infection (HAI) and cost, along with tools for adoption.

Because of the number of factors that contribute to surgical site infection, experts generally talk in terms of reducing the risk rather than the rate of SSI. Although SSI constitutes the second largest category among HAI, it is difficult to track the exact cause of infection. As such, we are placed in the realm of risk reduction. Here we take advantage of the evidence before us, combined with best practice, to create an environment of zero tolerance. Zero tolerance, as stated by the 2006 Association of Professionals in Infection Control and Epidemiology (APIC) President Kathy Arias, MS, CIC, “is not a number—it’s a culture in which healthcare providers strive to prevent as many healthcare-associated infections as possible. We may never eliminate every infection, and many cannot be prevented. But we should accept nothing less than the very lowest rates of infection and actively promote zero tolerance for the adverse outcomes of healthcare.”

The evidence presented comes from journal articles and organizations that support preoperative clipping and depilation of the hair for patient preparation. But it is important to remember that scientific evidence is but one component of persuasion. All of us as healthcare personnel subscribe to professional journals. We are all part of various professional organizations. We all operate within different institutions that have specific policies and unique cultures. So how do we handle the information that comes our way? The answer: it depends. Therefore, as we discuss hair removal we must ask ourselves, “What will we do with this information and how, in our own particular work environment, will we implement it?”

**Hair Removal (Evidence)**

The body’s first line of defense is the skin. The skin’s thick epithelium and its acidic pH provide bacteriostatic protection which decreases overall bacterial growth. Fatty acids from sebaceous glands and elements of normal skin flora also help to prevent bacterial growth.

A loss of any of these defenses, either by mechanical or chemical injury to the skin, or by the preoperative hair removal process, increases the risk of bacterial growth and infection. In other words, hair removal methods have been implicated as a culprit for increased SSI rates.

We now know that hair is best left alone and may not need to be removed from the operative site. Studies show that patients who have no hair removed have the lowest
Hair removal methods are an important factor to consider when looking at an overall approach to reduce the incidence of SSI. Surgical site infection rate. As early as 1971, Seropian and Reynolds reported a 0.6 percent infection rate in patients who did not require hair removal. Today it is common practice not to remove hair for obstetrical, gynecological and rectal surgery.

However, sometimes it is necessary to remove hair depending on the amount of hair, the location of the incision and the type of procedure to be performed. For practical reasons, hair must be removed when it interferes with the incision, interferes with the adhesion of incise drapes, interferes with the adhesion of patient plates, grounding pads or monitoring electrodes, or compromises the adhesion of postoperative dressings. The decision to remove hair is ultimately made by the surgeon or hospital policy. So if necessary, how and when should preoperative hair removal occur? Should we use a razor, a depilatory agent or use clippers? Let’s examine these three different methods of hair removal.

METHODS OF HAIR REMOVAL

In 1885, Gustav Newber of Germany was probably the first surgeon to advocate preoperative shaving of the hair on the surgical patient. Until 1965, this was considered a necessary and normal part of the preoperative skin prep process and was seldom questioned. Yet, clear and convincing research shows that shaving produces nicks, cuts and microscopic epidermal injuries that provide portals for resident and transient microorganisms on the epidermis and hair shafts. This permits bacterial contamination and increases the risk of surgical site infection. More than 30 years of accumulated data provide overwhelming evidence against the practice of preoperative shaving with a razor.

Much of the research examining the use of razors utilizes clippers as a comparison point. Some examples:

In 1973, Cruse and Foord published a five-year study identifying preoperative shaving with a razor as a major contributing factor to wound infection. In an expanded 10-year study of nearly 63,000 wounds, the same researchers found overwhelming evidence against the use of a razor.

In 1983, Alexander and colleagues compared hair removal methods using a razor compared to an electric clipper. The study showed that for hair removal performed the morning of surgery, razor shaving resulted in an infection rate of 6.4 percent—while clipping hair resulted in a significantly lower infection rate of 1.8 percent.

Sellick et al. found that using a clipper decreased the risks of deep wound infection. Ko et al. concluded that electrical clipping is superior to manual shaving in the prevention of suppurative mediastinitis. Alexander et al. found that clipping resulted in significantly lower infection rates than razor preparation, both at discharge of the patient and within a 30-day follow-up (see Figure 1).

Figure 1. Infection rates—Clipping vs. Shaving

O.K. So if shaving with a razor is out, is there something else to be used besides clippers? Yes, one can use a depilatory cream. When compared to shaving, depilatory use has also been shown to reduce infection rates. Seropian and Reynolds reported an infection rate 10 times higher for hair removed by razor (5.6 percent) than when a depilatory cream was used (0.6 percent) (see Figure 2). However, depilatories have drawbacks that must be weighed against potential benefits.
AORN recommends that if hair is to be removed, it should be done in a manner that preserves skin integrity.

For example, depilatories can produce hypersensitive reactions in some patients that could delay surgery and patients must be pre-tested for chemical sensitivity before surgery. Depilatories tend to be time consuming and messy; patients object to the unpleasant odor and mess; and depilatories cannot be used around the eyes or genitalia.

This accumulated data has led many organizations to the following conclusion: when feasible, the Association of periOperative Registered Nurses (AORN), the Centers for Disease Control and Prevention (CDC), the American College of Surgeons (ACS), and the Association of Professionals in Infection Control and Epidemiology (APIC), all call for no hair removal. Each group supports the need to change hair removal practice from shaving to clipping or use of depilatories.

The AORN recommends that if hair is to be removed, it should be done in a manner that preserves skin integrity. Therefore, clippers or chemical depilatory agents are the preferred methods of hair removal.\(^8\)

The CDC in their 1999 Guideline for Prevention of Surgical Site Infection state that if hair is removed, it should be removed immediately before the operation with an electrical clipper which is associated with lower infection rates than shaving. This recommendation was elevated to a Category 1A, which is the highest recommendation of the CDC. This means that the practice is strongly recommended for implementation by all healthcare facilities and is supported by well-designed experimental, clinical or epidemiological studies.\(^11,12\)

The ACS recommends either no hair removal or morning-of-surgery hair clipping at the surgical site.\(^10\) In the July 2000 Bulletin of the American College of Surgeons, the 1999 CDC Guideline for Prevention of Surgical Site Infection was summarized and endorsed.

According to APIC, the use of depilatories or clippers reduces microbial contamination of the wound and subsequently reduces infection risk.\(^11,12\)

**COMMITTED**

Once we have decided on a method of hair removal, there are some other things to consider such as location of hair removal, when and how to do it and the costs involved.

- **Location:**
  According to AORN Recommended Practices, hair should be removed outside the room where the procedure is to be performed. Because of airborne dispersal of loose hair, hair removed in the vicinity of the sterile field endangers the assurance of sterility.\(^8\)

- **When:**
  The timing of hair removal also has a direct impact on surgical infection rates. This has been shown for both

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Figure 2. Infection rates—Razor vs. Depilatory\(^2\)

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razor use and clipper use. Seropian and Reynolds showed that infection rates increased from 3.1 percent for patients shaved in the morning to 7.1 percent for those shaved the night before and to 20 percent for those shaved more than 24 hours before the procedure. Clipping hair immediately before the operation is also associated with a lower risk of surgical site infection than shaving or clipping the night before. For this reason, recommended practices support hair removal as close to the time of surgery as possible.

**How:**
If personnel are new to clipping, they should know that experts recommend leaving 1 to 2 mm of hair on the skin when clipping. When properly used, electrical clippers do not damage or abrade the skin. Concerns about stubble length go back to when clippers first entered the hair removal market in 1986. Studies show that remaining stubble demonstrates preserved skin integrity and that razors cause microscopic cuts and nicks, some of which are not visible to the naked eye. “In fact, the stubble should be reassuring,” commented William C. Beck, MD, FACS, in a 1986 editorial in *Surgery, Gynecology & Obstetrics*: “it gives assurance that the superficial skin squames have not been disturbed.” Comments made by panelists at an AORN Q&A session in 1982, recommended clipping the hair, leaving 1 to 2 mm on the skin. “When properly used this way, the electrical clippers do not damage or abrade the skin.”

**Cost:**
In summary, if hair must be removed, clipping offers clear benefits over shaving or depilatories. Consider that clipping causes fewer delays at the beginning of surgical procedures, causes no depilatory rash, and results in more efficient use of the operating room staff. Hamilton and Hamilton even found that clipping cost less as well. In an article in the *Canadian Journal of Surgery* they detailed that the cost of clipping was less
than half the cost of using a razor for preoperative prepping, and 11 times less than using a depilatory (see Figure 3). This savings is related to the hair removal technique itself, but there is even a greater savings achieved by a reduced infection rate.

Figure 3. Cost of Clipping vs. Razor and Depilatory

It is well known that infections lead to longer hospital stays. Alexander et al. found that hospital stays for infected patients varied with the severity of infection. He writes, “In our hospital, which has a current (1982-1983) per diem rate of $419, the savings per 1,000 patients treated would be $274,780 if the AM clipper method were used exclusively. Data from the Division of Health Care of the National Center for Health Care Statistics indicate that 23,858,000 operations were performed in the United States in 1979. Assuming that at least half of surgical patients have hair removed; if preoperative shaving were abandoned in favor of hair removal by AM clipper or a depilatory, the annual savings in the United states could be more than $3 billion.”

SSI as part of Healthcare-Associated Infections

What we do on a daily basis matters. Not only to the patients for whom we care, but also to the overall economic impact of our healthcare system. So let’s look at the broader category of HAI to gain more perspective on our discussion of hair removal. Healthcare-associated infection is defined as an infection affecting patients who receive either medical or surgical treatment. There are approximately 4.5 infections per 100 hospital admissions, 9.3 infections per 1,000 patient days in Intensive Care Units (ICUs), and 2 surgical site infections per 100 operations. These estimates are based on best available data, but some infections are known to be underreported, so the actual number of healthcare-associated infections may be higher.

An updated report from the CDC shows that HAI accounts for an estimated 1.7 million infections and 99,000 associated deaths each year. Of these infections:
- 32 percent are urinary tract infections;
- 22 percent are surgical site infections;
- 15 percent are pneumonia;
- 14 percent are bloodstream infections.

What can we do about it? Are these infections preventable? If so, to what degree? According to an overview of published reports performed by Harbarth, Sax and Gastmeier there is great potential for prevention. Their systematic review of 30 reports suggests that great potential exists to decrease HAI rates ranging from a minimum reduction effect of 10 percent to a maximum effect of 70 percent, depending on the setting, study design, baseline infection rates and type of infection. They consider that at least 20 percent of all HAI is probably preventable. Some of the essential components of effective infection control programs included conducting organized surveillance and control activities, having a trained infection control practitioner per 250 beds, and a system for reporting infection rates to practicing physicians.

Taking into consideration the number of deaths each year due to HAI and the associated cost of $5-6 billion annually, a 20 percent reduction of all HAI would be substantial. This level of reduction would require us to think more about zero tolerance and consider an overall economic impact.

When we look at reduction data, we always see some lower percentage such as 6 percent or 10 percent. So after reading an article that states a minimum reduction of HAI, we might be quick to assume that they are inevitable. John A. Jernigan, MD, MS, of the CDC acknowledges reduction data and had some helpful suggestions on “zero tolerance” in his presentation, State of the Union on Healthcare-Associated Infections. In looking at reduction data Jernigan comments, “some may have interpreted these data (reduction data) to mean that most healthcare-associated infections are inevitable.” He asks:
- What impact has this had on the psychology of prevention?
- How has this influenced the way infection control programs operate?

In looking at recommended practices and zero tolerance:
- Most HAI can be prevented by successful implementation of currently recommended preventive practices.
- We should have “zero tolerance” for breaches in proven prevention practices.
- Elimination of HAI should be considered a theoretical goal. (Pursuing perfection.)

He also recognized a few potential drawbacks of “zero tolerance” such as:
Inappropriate assigning of “blame.”
Avoiding high-risk patients.

We can observe the fruition of the ideas posited above in a recent article published by the Association for Professionals in Infection Control and Epidemiology,\textsuperscript{21,22} In *Dispelling the Myths: The True Cost of Healthcare-Associated Infections*, APIC examined common misperceptions about HAI and presented a business case for their prevention. Included were examples of hospitals that generated significant savings by adopting best practices as well as recommendations for ways hospital leaders can cut HAI related costs at their own organizations.

Key Findings:
\begin{itemize}
  \item HAI should not be an expected by product of treating an older, sicker patient population with an increasing array of
invasive techniques. Organizations pursuing elimination programs are finding that HAI is often preventable through the application of evidence-based guidelines.

- Additional payment or reimbursement typically does not offset the cost of an HAI. Most patients in a hospital are covered by government payers (Medicare and Medicaid), which, in most cases, pay fixed amounts. The additional costs associated with HAI must be absorbed by the hospital.

- The number of HAI in most organizations is significant, making the cost savings associated with their reduction worth pursuing. A recent study of 1.69 million admissions from 77 hospitals found that patients with an HAI reduced overall net inpatient margins by $286 million—what amounts to $5,018 per infected patient.

With these points in mind, APIC believes pursuing perfection, that is, setting HAI reduction strategies at the theoretical ideal (zero preventable infections) represents a substantial opportunity for hospital leaders to improve safety and quality, and significantly reduce cost.  

**Implementation**

As members of the healthcare team, surgeons, nurses and other healthcare professionals are entrusted with the safety and welfare of those who undergo surgical intervention. As a patient advocate, the perioperative nurse has, as one of his or her most important functions, the responsibility for monitoring and maintaining best practices during the perioperative period. A surgical conscience (that concept which allows for no compromise in the principles of aseptic technique) builds on the principles of asepsis and is an act of mental discipline. It involves inspection and regulation of one’s own practice, with particular attention to deviations from acceptable, safe practices, especially during the intraoperative phase of the surgical experience.

As the surgical conscience is fully developed, the perioperative nurse is always asking himself or herself:

1. Is this the best practice?
2. Do I have everything necessary for this procedure?
3. Have I done all I can do to provide a safe, therapeutic environment for my patient?

Considering the evidence presented for methods of hair removal in the context of HAI and cost we might ask “What can we do about it?”

The Institute for Healthcare Improvement (IHI), whose goal is to help accelerate the measurable and continual progress of healthcare systems, has many tools available to help in implementation of evidence-based strategies. They note that effective surgical infection prevention and harm reduction require redesigning systems with safety in mind. The fundamental law of improvement is this: every system is perfectly designed to achieve exactly the results it gets. In order to attain a new level of performance in safety, there must be a new system. Considering that 69 percent of adverse events and deaths in healthcare occur due to an error in management and thus are potentially preventable, they look to enlighten management teams, regulatory agencies, health plan providers/purchasers, and medical associations that provide the support required to create a culture of patient safety in our healthcare systems. Not only are there preventable adverse events and deaths to consider but also the challenge of trying to integrate new evidence-based infection prevention strategies into practice. The IHI aims to support, inform and empower hospital teams to make key changes to their subsystems (e.g., surgical units) and to incorporate safety considerations into their everyday work.

The IHI recognizes that shaving the operative site has been demonstrated to affect significantly the risk of SSI. They point out that avoiding shaving the operative site provides opportunities for improvement in most hospitals.

**Changes for Improvement:**

- Remove all razors from operating room and supply area.
- Perform hair removal when necessary with clippers right before surgery.
Education & Training

- Establish a protocol for when and how to remove hair in affected areas.
- Provide patient education and materials on appropriate hair removal techniques to prevent shaving at home.
- Avoid shaving heart surgery patients for EKG studies conducted shortly before surgery.

They suggest the Model for Improvement to create new and safer systems for reducing Surgical Site Infection.2 The Model for Improvement, developed by Associates in Process Improvement, is a simple yet powerful tool for accelerating improvement. The model is not meant to replace change models that organizations may already be using, but rather to accelerate improvement. This model has been used very successfully by hundreds of healthcare organizations in many countries to improve many different healthcare processes and outcomes. The key elements of the model are:

1. Form a team;
2. Set aims;
3. Establish measures;
4. Select changes;
5. Test changes.

NO 1. FORM A TEAM

It is essential that surgical site infection reduction efforts are led by a multidisciplinary core team. Reducing the incidence of SSI in a healthcare organization is not just the job of nurses or surgeons. It is everyone’s job. And “everyone” does not mean only clinical personnel, but anyone who interacts with patients or has a role in any care process. This includes operating room technicians and environmental services personnel. It is, therefore, absolutely essential that surgical infection reduction efforts be led by a multidisciplinary core team. An organization typically has several teams working on more than one aim at a time, but all teams should report to one oversight team.

Example of an effective team to reduce cardiac surgical site infections

- Aim: Double the number of surgical cases between incidences of cardiac surgical site infection (SSI) within 13 months.

- Core Team—The overall core team must be interdisciplinary and must include, at a minimum:
  - Cardiac Surgeon;
  - Nurse Manager of Operating Room;
  - Anesthesiologist;
  - Patient Safety Officer (if the organization has one).

- Additional team members:
  - Infection Control Nurse;
  - Quality director;
  - Risk manager.

Sub-teams may be formed to work on key changes (i.e., use of clippers) since work should be done in parallel, but all should be coordinated and overseen by the core team.
The first step in reducing SSI is making a solid commitment to improve care. This commitment should be reflected in a strong and well-worded aim statement that sets an aggressive goal. It is critical that the overall aim reflect a goal to reduce SSI rates significantly, in a measurable way and in a specified time frame. For example, an organization wishing to make a real commitment to reducing SSI should set an aim stating: Double the number of surgical cases between SSI occurrence within 13 months. Senior leaders should be involved in setting the aims to ensure that the aims are aligned with the organization’s strategic goals. When senior leaders approve the aims, they should also make a commitment to give the team whatever support is needed to achieve those aims.

Example of an effective Aim Statement
Note that the overall aim is outcome oriented, with specific numeric goals for the care processes. The timeframe for reaching all goals and the aim was 13 months.

AIM:
1. Double the number of surgical cases between SSI occurrence.
2. Achieve 100 percent compliance with the use of clippers for hair removal with appropriate timing preoperatively:
   • 100 percent of patients will, if needed, have hair removed by use of clippers.
   • 100 percent of patients will have hair removed in a manner that is consistent with published guidelines.
   • 100 percent of patients undergoing hair removal will have hair removed within one hour before surgery.

NO. 3. ESTABLISH MEASURES
Improvement in outcome measures reflects the health status of the patient, whereas process measures reflect the care delivery to the patient. Improvement in outcome measures has a direct effect on mortality and morbidity. It is important to track three types of measures when you are working to reduce surgical site infection incidence.

a) Outcome Measures: These measures tell you whether changes are actually leading to improvement—that is, helping to achieve the overall aim of reducing the incidence of surgical site infection (SSI). Improvement in outcome measures reflects the health status of the patient and has a direct effect on mortality and morbidity. An example of an outcome measure is: Number of Cases between the incidence of Surgical Site Infection.

b) Process Measures: To affect the outcome measure of reducing the incidence of SSI, you will make changes to improve core processes—including processes for use of prophylactic antibiotics, maintenance of body temperature and hair removal technique. Measuring the results of these process changes will tell you whether the changes are leading to an improved system and will reflect the care delivery to the patient. An example of a process measure is Percent of Surgical Cases with On-Time Use of Clippers Preoperatively.

c) Balancing Measures: Use these measures to make sure that changes to improve one part of the system aren’t causing new problems in other parts of the system. For example, when focusing on appropriate administration of prophylactic antibiotics, it is important to also monitor the incidence of resistant bacterial strains to ensure that overuse of antibiotics does not occur.

NO. 4. SELECT CHANGES
Teams must test and implement changes in order to reduce the incidence of SSI. These may include: use of antibiotics, temperature management (perioperative normothermia), glucose control, oxygen administration, and clipping of the operative site.

Effective SSI requires redesigning systems to reduce risk factors and to optimize evidence-based processes of care. Again, the fundamental rule of improvement is this: every system is perfectly designed to achieve exactly the results it gets. In order to attain a new level of performance in patient safety, there must be a new system. This applies to all forms of performance—such as selection, timing and duration of antimicrobial prophylaxis; thermoregulation; oxygen tension; glucose control; hair removal technique and other basic prevention strategies. Many healthcare organizations have succeeded in creating new and safer systems. Major opportunities still exist to reduce the incidence of each surgical infection, create safer care for patients requiring surgery, reduce costs and improve efficiency.

The fifth step, Testing Changes, incorporates the Plan-Do-Study-Act (PDSA) cycle which is shorthand for testing a change in the real work setting by planning it, trying it, observing the results and acting on what is learned. This is the scientific method used for action-oriented learning and guides the test of a change to determine if the change is an improvement.

NO 5. TESTING CHANGES:
THE PLAN-DO-STUDY-ACT CYCLE.
Testing changes to care processes must be done carefully so as not to add additional error and harm to the system. Use PDSA cycles to test changes on a small scale before implementing them broadly.
Test changes to surgical care processes on a small scale to ensure not only that they are successful, but also that they can be understood clearly by all and implemented safely. You may find that some clinicians do not readily accept changes to clinical processes, so results from their colleagues tests can help demonstrate possible successes and gain support for the proposed change.

The key to making effective changes is rigorous testing before broader implementation. Members of teams in all kinds of organizations can study the examples of testing changes here as they design their own tests.  

Conclusion

Hair removal methods are an important factor to consider when looking at an overall approach to reduce the incidence of SSI. As we have discussed, the impact of our actions is very real with respect to patient outcome and economic impact. We are all still learning and the nice thing is, we are not alone. It takes a team to obtain a lasting measurable change to our current practices. We are that team. +

References

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ANSWERS
1. a 6. d
2. a 7. c
3. d 8. b
4. a 9. a
5. b 10. d


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