Open surgical wounds: how does Aquacel compare with wet-to-dry gauze?

**Objective:** To compare the healing rates of a hydrofibre dressing (Aquacel) and normal wet-to-dry gauze in the treatment of open surgical wounds.

**Method:** Fifty patients with open surgical wounds were randomised to receive either saline-moistened gauze or Aquacel. The rate of wound healing was measured as ml/day (deep wounds) or cm²/day (superficial wounds) at each dressing change until an investigator blinded to the patient group diagnosed the wounds as having healed or the patient was withdrawn from the study.

**Results:** Of the 50 patients, seven were withdrawn from the study after the first evaluation. Of the remaining 43 patients, 21 had been randomly allocated to the gauze group and 22 to the Aquacel group. For deep wounds, a mean change in the wound healing rate of 1.9 ±1.3 cm²/day was reported for the gauze group and 2.9 ±2.3 cm²/day for the Aquacel group. These results approach statistical significance (p=0.082). For superficial wounds, the mean change in the healing rate was 1.6 ±1.5 cm²/day for the gauze group and 1.9 ±2.2 cm²/day for the Aquacel group, but this was not statistically significant.

**Conclusion:** Aquacel appears to be at least as effective as wet-to-dry gauze in the healing of open surgical wounds.

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pen surgical wounds are often associated with pain at dressing change and require prolonged hospitalisation. Management includes surgical debridement, infection control, pressure relief and revascularisation. Even when properly treated, these wounds may not heal as expected, resulting in incomplete closure and thus requiring considerable nursing care. If a decision is made to manage them on an outpatient basis, patients and relatives will need to be taught how to do complex dressing changes, or private home nursing care visits will have to be arranged. These open wounds can be complicated by superficial infections, fistulae or, in rare cases, gas gangrene. Most surgeons in the USA still use a three or four times daily regimen of wet to dry normal saline-moistened gauze dressings to debride such wounds and stimulate granulation. Gauze may delay healing if it adheres to the wound bed, and it often lifts off newly formed granulation tissue when removed, which is painful for the patient.

Aquacel (Convatec) is a new hydrofibre dressing (carboxy-methyl-cellulose) designed to promote tissue repair in open surgical wounds. When in contact with a wound, its fibres absorb exudate and align in a vertical manner, perpendicular to the wound surface. Debris and wound fluid are then removed and contained within the dressing. This process is called vertical wicking.

An earlier study comparing Aquacel with wet to dry gauze in patients with foot ulcers demonstrated that it improved healing rates and decreased the burden of local care. This prospective randomised controlled pilot trial compares traditional wet-to-dry saline-moistened gauze with Aquacel in the management of open surgical wounds. We hypothesised that use of Aquacel would increase the rate of wound healing.

**Method**

**Patients**
The initial sample comprised 50 patients with open surgical wounds admitted to the Trauma/Emergency Surgical Service at the University of Miami/Jackson Memorial Medical Center. All were aged over 17 years, had open surgical wounds ≥10.17 cm and had been using wet-to-dry gauze dressings before entering the study. Exclusion criteria were clinical signs of infection or wounds with open fascia.

The primary endpoint was the rate of wound healing measured as cm² (ml)/day (deep wounds) or cm²/day (superficial wounds). Secondary endpoints were wound complications (infections, fistulae) and hospital length of stay.

**Baseline evaluation**
A subject demographic form was completed for each patient. Age, sex, height, weight and body mass index (BMI) were recorded. The patient's
primary diagnosis was also noted and a general health status (1 = excellent to 4 = poor) assigned. An investigator blinded to the study arm group was responsible for the primary assessment and subsequent wound management.

Initial evaluation
The target wound's maximum length, width and depth were measured at the initial evaluation. Deep wounds were also measured using the Berg procedure, a saline injection technique used to measure wound volume. To do this, an investigator blinded to the study arm measured wound volume first at baseline, then weekly while the patients were in hospital and finally at hospital discharge. The surgical wound was covered with a transparent adhesive film, through which sterile saline was injected to fill the wound volume. A separate needle was then placed through the film at its highest point to permit air to escape. The volume (ml) of saline required to fill the wound was recorded. The weekly change in volume indicated the change in wound size.

The amount of exudate (1 = none, 2 = slight, 3 = moderate) and the percentage of healthy granulation tissue visible in the wound were also assessed. The clinician who assessed the wounds was blinded to the treatment group.

To optimise healing, necrotic tissue was surgically debrided during the initial and follow-up visits when necessary. There were no variations in debridement technique.

Dressing changes
Aquacel can be left in place for up to seven days, but the number of dressing changes varied depending on the amount of exudate produced. The gauze dressings were changed daily or more frequently if required.

At each dressing change the investigator assessed and recorded the following:
- Treatment group
- Appearance of the wound bed
- Amount of exudate
- Condition of the wound
- Clinical signs of infection

All wounds were followed daily for signs of inflammation (erythema, induration, warmth) until the patient was discharged. After this they were monitored in clinic until wound healing was complete or the patient was withdrawn from the study. Complete healing was defined as 100% re-epithelialisation of the wound surface with the absence of drainage. Wounds were considered infected if purulent discharge was detected, or possibly infected if there were signs of inflammation or a serous discharge.

In addition, an observer (either a physician, nurse practitioner or physician's assistant) blinded to the type of dressing used measured the wound area (cm²) and wound volume (ml).

Each study clinician was given sufficient training in wound assessment, and all data were reviewed to identify any misleading measurements. Study clinicians initially evaluated the wounds together to optimise assessment reliability.

These data were collected at the dressing changes and stored in a computer database. Patients continued to receive dressing changes until, at the final evaluation, an investigator diagnosed that the wound had healed.

Final evaluation
At the last clinic visit the investigator completed a final evaluation form recording details of the patient's exit from the study or, if the patient withdrew early, the reason for this. The rate of wound healing was also determined and whether or not an infection was present.

Statistical analysis
As little data are available in the literature on the rate of wound healing in open surgical wounds managed with wet-to-dry gauze or Aquacel, a convenience sample of 50 patients was used.

The rate of complete wound healing was measured by dividing the area and volume of the wound by the number of days from the start of treatment to the date that a patient either achieved complete wound healing (wound closure) or withdrew.

Differences between the groups in wound-healing rates were analysed using Student's t-test, and categorical variables were crossed using chi-square tests. Significance was defined as p<0.05.

Results
From September 2000 to April 2002, 50 patients at our centre with an open wound were enrolled and randomised to receive either wet to dry gauze or Aquacel. Of these 50 patients, four in the Aquacel group and three in the gauze group were withdrawn after the initial evaluation. They were discharged to an outpatient wound-care programme and were lost to follow-up.

Of the remaining patients, 21 (11 male and 10 female) were in the gauze group and 22 (12 male and 10 female) in the Aquacel group. The mean age was 48 ±14 years for the Aquacel group and 50 ±16 years for the saline group. The average number of hospital days for the Aquacel group was 57 ±42 and 40 ±13 (p=0.13) for the gauze group.

The average general health status score (1.8) was equivalent for both groups. Three patients had diabetes (two Aquacel, one gauze), of whom one (Aquacel) was receiving insulin therapy. None reported peripheral vascular disease (arterial or venous), immunosuppression or steroid use.
Most wounds (68%) were located in the midline abdominal region. Others were in the right and left lower abdominal quadrants, lateral thigh, calf and posterior shoulder.

At the initial evaluation, wounds in the Aqualc group and gauze group, respectively, had a mean length of 17.8cm ± 9.7 and 15.7cm ± 5.95, a mean volume (measured by Berg's procedure) of 82.2ml ±76.1 and 57.5ml ±40.8 and a mean surface area of 90.5cm² ±78.1 and 66.3cm² ±43.8. There was no statistical difference in wound characteristics between the two groups at baseline.

Two wounds in the gauze group and one wound in the Aqualc group were treated for an infection. All but four patients in the study (two in each study group) were surgically debrided. Healthy granulation tissue growth was noted in 36% in the gauze group and 39% in the Aqualc group. Three patients in the gauze group had high to moderate exudate in the wound bed compared with five in the Aqualc group. All patients experienced some degree of healing during the observation period.

In the gauze group the mean rate of healing of superficial wounds measured by changes in surface area (cm²/day) was 1.6 ±1.5 compared with 1.9 ±2.2 for the Aqualc group, giving a p-value of 0.597 and a 95% confidence interval (CI) of -0.838 to 1.438.

Wound healing in deep wounds measured by changes in Berg measurement (ml/day) was 1.9 ±1.3 for the gauze group compared with 2.9 ±2.3 for the Aqualc group (Fig 1), giving a p-value of 0.082 and a 95% CI of -0.1316 to 2.132.

Although the healing rates appeared greater for patients in the Aqualc group, these results did not reach statistical significance.

**Discussion**

The analysis indicated that Aqualc achieved faster healing rates than wet-to-dry gauze, but this was not statistically significant.

Wound healing is a complex process that incorporates various physiological processes to promote cellular growth and proliferation. Managing the open wound with the appropriate dressing is an important factor in preventing infections and further complications.

Aqualc hydrofibre dressing is an alternative to conventional wet-to-dry gauze for open surgical wounds. Previous studies have tested these hydrogel dressings on multiple clinical conditions including burns, venous ulcers and pressure ulcers, with generally satisfactory outcomes.²³

With regard to comfort during dressing changes, the hydrofibre dressings consistently outperformed gauze dressings in both patient and nurse assessments.²³ In addition, hydrofibre dressings have been associated with a lower incidence of infection.²³ Aqualc requires fewer dressing changes, and this may lead to a more stable healing environment with less disruption in the formation of healthy granulation tissue. None of these studies, however, demonstrated a statistically significant advantage for Aqualc over wet-to-dry gauze.

Our study was not designed to assess the frequency of dressing changes or the level of associated pain.

This randomised pilot study was unique in comparing Aqualc with wet-to-dry gauze specifically in open surgical wounds. Although larger studies are needed to strengthen our findings, our results indicate that Aqualc is as good as, if not better than, the gauze in providing an adequate healing environment. Aqualc had a 57% higher rate of healing for deep wounds than gauze.

A power analysis based on these preliminary results revealed that a study sample of 40 patients per group would be needed to reach statistical significance. It was not possible to perform a sample size estimate as no data were available on this population. Using t-test for power analysis based on our preliminary results of the healing rates of deep wounds, 28 subjects per group would have been required to reach statistical significance (p<0.05).

The primary limitations of our study included our limited patient population size and the inability to follow some patients throughout the healing process. However, we believe that the ease with which Aqualc can be applied and then changed, when compared with wet-to-dry gauze, is beneficial to both nurses and patients. By reducing the time required both for daily dressing changes and wound management, this dressing may reduce the need for resources and, ultimately, hospital costs.

**Conclusion**

This trial demonstrates that Aqualc was at least as effective as wet-to-dry gauze in promoting wound healing rates in open surgical wounds.

We propose that Aqualc might play an important role in the management of such wounds as it was associated with higher healing rates than wet-to-dry gauze dressing, although this was not statistically significant, and appeared to be well accepted by patients.