

## Technical Note

# DEFIBRILLATION ON A WET OR METAL SURFACE

## SUMMARY

It is safe to defibrillate a patient on either a wet or metal surface as long as the appropriate safety precautions are taken. Specifically, care should be taken to ensure that no one is touching the patient when the shock button is pressed.

HeartStart Automated External Defibrillators are designed to be easy to use and have clear text and/or voice prompts that reinforce the proper use of the product. When the HeartStart defibrillator is analyzing the ECG, it will announce, “Do not touch the patient.” When it decides to shock and charges, it will tell the user to stay clear of the patient. It will also inform the user when it is safe to touch the patient. All these messages are intended to make the unit safer and easier to use.

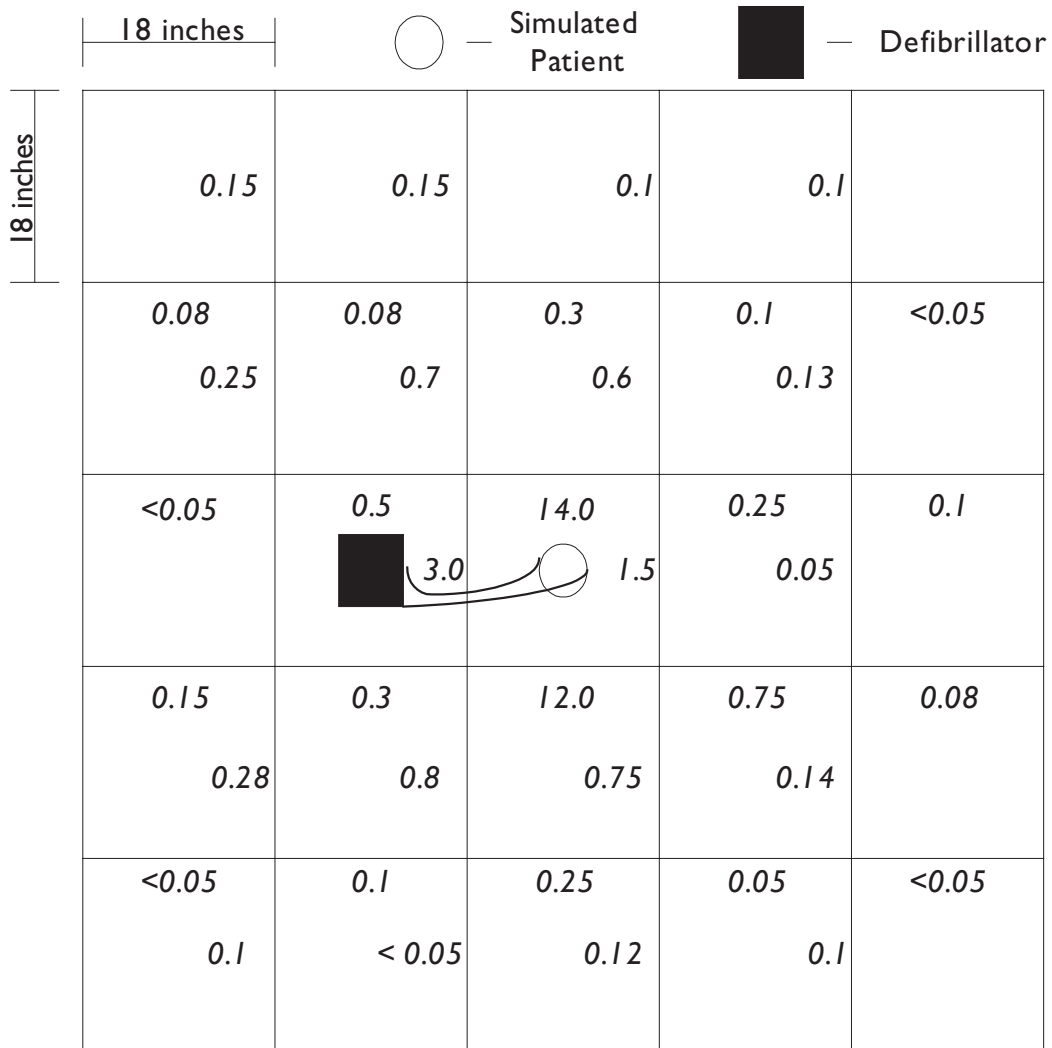
## BACKGROUND

When a patient is externally defibrillated, the current that travels between the pads will always seek the path of least resistance. Some of this current will pass over the surface of the patient's skin, and if the patient is resting on an electrically insulating surface, all defibrillation energy is kept within the patient. If the user does not touch the patient during the discharge, there is no danger of them receiving a shock, as there is not a current path that would cause the user to experience a shock. However, if the patient is resting on a somewhat electrically conductive material, such as a wet surface, some of this energy may pass outside the patient. It is the presence of this energy near the patient that has prompted concern of electrical shock hazards to caregivers or bystanders during delivery of defibrillation.

Historically, patients have been defibrillated without harm on both insulating and conductive surfaces. For example, dry flooring (such as wood) does not conduct stray currents, hence inducing no potential gradient around the patient. At the other extreme, patients on metal surfaces (such as the floor of a helicopter) are also defibrillated safely, as the electricity is completely conducted through the metal and away from any bystanders. According to the American Heart Association (*Guidelines 2000*), metal surfaces “pose no shock hazard to either the victim or rescuer.”

## TESTING

To confirm there would be no effect on the user, Philips has simulated a 150J SMART Biphasic shock to a patient on a wet concrete surface using chlorinated pool water.<sup>1</sup> The voltages created in the water were tested at various points away from the simulated patient to verify that no danger existed to the user. This grid below shows the leading edge peak voltage (in Volts) recorded during a defibrillation shock measured at each location on the grid.



*Numbers in Italics are Voltages at Locations*

1. Vance et.al. Automated External Defibrillation in a Wet Environment World Congress on Drowning 2002, Amsterdam, 26-28 June 2002, Book of Abstracts, p.169

The maximum peak voltage of 14 volts occurred at a distance of approximately six inches from the simulated patient. Fourteen (14) volts are unlikely to cause any operator or bystander sensation or risk in this environment.

The voltages quickly lowered as the distance from the patient increased. At a distance of approximately 2 feet away from the patient, the maximum voltage was only 0.28 volts. At this voltage, there is virtually no operator or bystander sensation or risk in this environment.

It should be noted that the voltage recorded on the Defibrillator Shock Button was 0.4 V or less when placed 18 inches from the simulated patient, resulting in no sensation or risk to the user when the button is pressed.

## CONCLUSION

Our simulation of patient defibrillation in a pool water environment demonstrated that an operator touching the defibrillator was at particularly low risk. Bystander risk in an actual defibrillation event is likely to be considerably less than the simulated bystander risk, because patient head and limbs will provide greater separation between the bystander and the defibrillation pad area.

Operation of the defibrillator in a rainy environment should present no additional risks to the operator or bystanders, since the conductivity of rainwater will be less than the pool water.