Bacterial Protease Activity in Chronic Wound Fluid, a Potential Indicator of Pathogenicity even in the Absence of Overt Signs of Infection

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AIM:

Pathogenic bacteria produce proteases (virulence factors) in the process of invading their host. Therefore, bacterial protease activity (BPA) may be a useful method of detecting the presence of pathogenic bacteria in wounds.

METHOD:

366 patients with chronic wounds from 6 wound care centres in the United States underwent assessment for the signs of infection using validated assessment criteria[1]. The wounds were swabbed to assess bacterial protease activity levels and quantitative bacterial load.

1. Woo KY, Sibbald RG. Cross-sectional validation study using NERDS STONEES assess bacterial burden. Ostomy Wound Manage. 2009. 55-8 40-8.

Background

The Chronic Wound Infection Continuum [2,3]

	Vigilance required		Intervention required	
Stages of chronic wound infection continuum	Not infected / Contamination	Colonisation	Local Infection / Critically Colonisation	Infected
	The presence of bacteria within a wound without host reaction	The presence of bacteria within the wound which do multiply or initiate host reaction	Multiplication of bacteria causing a delay in healing, usually associated with an exacerbation of pain not previously reported but still with no overt host reaction	The deposition and multiplication of bacteria in tissue with an associated host reaction

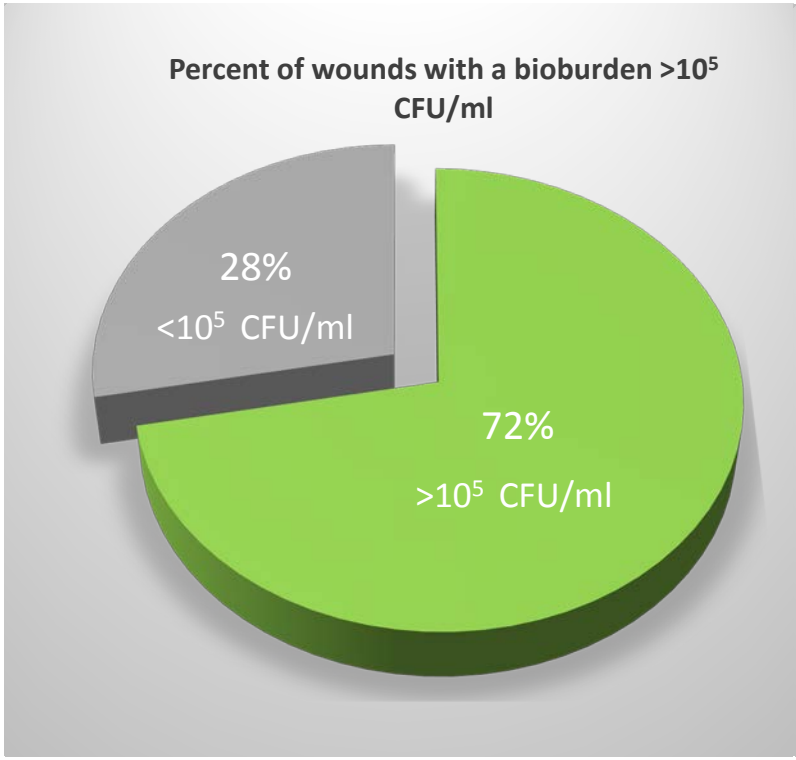
<u>Clinical problem:</u>

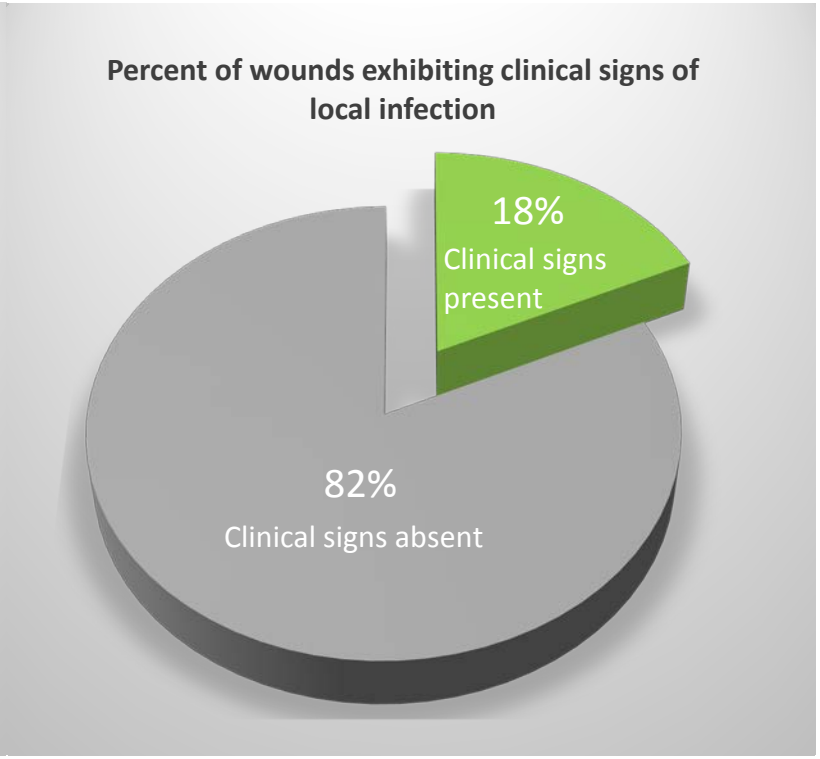
Effectively identifying wounds that are in a ‘state of pathogenicity’ and are infected or are becoming infected and would benefit from appropriate intervention.

2. Wound Infection in Clinical Practice: An international consensus. *International Wound Journal* 2008; 5 (3): 1-11.

3. Collier M. Recognition and management of wound infections. *World Wide Wounds* 2004.

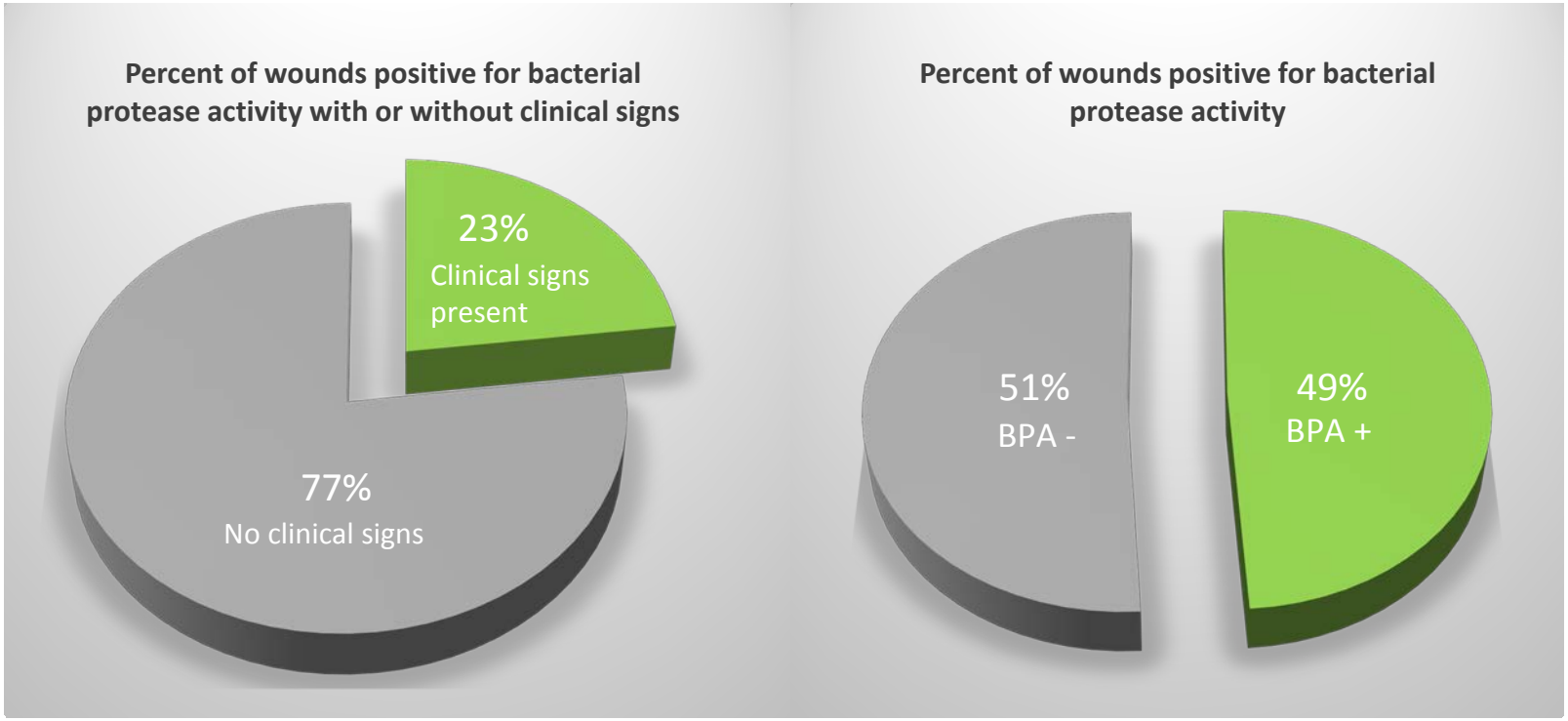
Results





- Approximately 70% of wounds had more than 10^5 colony forming units per ml.
- However, only 18% of wounds exhibited signs of local infection.

Results



- In contrast to bioburden and clinical signs, about half of all wounds swabbed were positive for bacterial protease activity.

- Of the BPA positive wounds, over three quarters did not have signs of local infection. We suspect that these wounds had bacteria in a pathogenic state present but had not yet progressed to overt infection.

Discussion / Conclusions

- Presence of pathogenic bacteria in a wound can cause a 'state of pathogenicity' that leads to local infection and impairs healing.

- Clinical examination can mis-diagnose infections in chronic wounds.
  - Some chronic wounds fail to exhibit the classic signs of infection[4,5]
  - Inflammation in wounds can be misinterpreted as infection[6].

- Culture techniques have limited reliability on their own, frequently leading to the over diagnosis of infection.

- Bacterial proteases are a type of virulence factor which have been implicated in a range of medical conditions, including wound infections.
  - Testing wound fluid for bacterial protease activity may be a useful method for detecting the presence of pathogenic bacteria, at a clinically significant stage in the infection continuum, even before the signs of infection are apparent.

4. Medina, A., Scott, P.G., Ghahary, A., Tredget, E.E. The pathophysiology of chronic nonhealing wounds. J Burn Care 2005. Rehabil 26:306-319.
5. Peleg, A.Y., Weerarathna, T., McCarthy, J.S., Davies, T.M.E. Common infections in diabetes: pathogenesis, management and relationship to glycaemic control. Diabetes Metab Res Rev. 2007. 23 3-13
6.Gardner SE, Frantz RA, Faan RN, Doebbeling BN. The validity of the clinical signs and symptoms used to identify localized chronic wound infection. *Wound Rep Reg*. 2001; 9: 178-186.