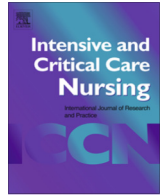


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Research Article

Moisture associated skin damage (MASD) in intensive care patients: A Norwegian point-prevalence study

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ABSTRACT

Background: Critically ill patients are at risk of developing moisture associated skin damage and pressure ulcers. These conditions may co-exist and be difficult to distinguish, but a simultaneous investigation may provide a true prevalence.

Objectives: To investigate the prevalence of moisture associated skin damage and associated factors among Norwegian intensive care patients.

Methods: A multi-centre one-day point-prevalence study.

Results: Totally, 112 patients participated in the study. Overall, 15 patients (13%, 15/112) had some type of moisture associated skin damage of which six cases (5%, 6/112) were related to faeces and/or urine (incontinence associated dermatitis). Skin breakdown occurred primarily in the pelvic area. Overall, 87% (97/112) had an indwelling urinary catheter. Stools were reported in 42% (47/112) of the patients on the study day, mostly liquid or semi-liquid. Overall, 11% (12/112) had a faecal management system. Only a few care plans for moisture associated skin damage prevention and care existed.

Conclusion: Patients in this study were vulnerable to skin breakdown in the pelvic area. Nevertheless, a low prevalence of skin breakdown existed. This may relate to intensive care nurses' qualifications, the 1:1 nurse-patient staffing, the high prevalence of urinary catheters and few patients having stools.

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Implications for clinical practice

- A low prevalence of moisture associated skin damage was found in intensive care patients in Norway.
- Incontinence associated dermatitis among intensive care patients is more likely caused by faeces rather than urine due to a high prevalence of urinary catheters.
- The prevalence of liquid and semi-liquid stools among intensive care patients was high.

Introduction

The skin is the body's largest organ and its vital function is to protect us from pathogens (Drake et al., 2010; Woo et al., 2017). Critically ill patients in the intensive care unit (ICU) are at risk of developing skin breakdown such as moisture associated skin damage (MASD) (Bliss et al., 2011; Coyer and Campbell, 2018; Johansen et al., 2018; Valls-Matarín et al., 2017; Wang et al., 2018) and

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pressure ulcers (PU) (Cremasco et al., 2013; Lahmann et al., 2012; Manzano et al., 2010; Manzano et al., 2014; Nijs et al., 2009; Rogenski and Kurcgant, 2012).

MASD is an umbrella term for erythema, inflammation and/or skin erosions including incontinence-associated dermatitis (IAD) (caused by urine or faeces), intertriginous dermatitis (occurring inside and adjacent to skin folds due to moisture and friction) (Gray et al., 2011), peristomal dermatitis (occurring around a uro-, ileo-, colo-, and/or tracheostomy) and peri-wound dermatitis (caused by wound exudate) (Woo et al., 2017). The extent of the problem depends on several internal and external factors (Woo et al., 2017) where ICU nurses most likely recognise pus and fluids from various stomas, excessive sweating, deep body folds, diarrhoea and excessive wound exudate as relevant risk factors for MASD. Risk of developing IAD in ICU patients may not be restricted only to incontinence, but to the fact that many patients have loose stools or diarrhoea (Jack et al., 2010), are bedbound and need help to manage stools and to perform personal hygiene. Previous studies have found that 21–95% of ICU patients may suffer from IAD (Bliss et al., 2011; Coyer and Campbell, 2018; Johansen et al., 2018; Valls-Matarín et al., 2017; Wang et al., 2018). Whereas MASD is a “top down” injury on the skin surface, PU is caused by damage initiated by changes in the soft tissue below and within the skin due to pressure and/or shear forces (“bottom up injury”) (National Pressure Ulcer Advisory Panel et al., 2014; Ousey et al., 2017). Although the aetiology of IAD and PU differs, recent publications have focused on how IAD and incontinence may increase the risk of developing PU (Beeckman, 2017).

ICU nurses must not only know how to prevent and treat MASD, but also be able to distinguish MASD from PU because the cause, prevention and care of the two conditions differs considerably (Lee and Kim, 2016). Being able to distinguish IAD from PU is also important due to the fact that these conditions may co-exist (Ousey et al., 2017) and it has been discussed how health care workers are challenged by distinguishing red skin being IAD from redness being PU (Beeckman, 2017).

It is suggested that the prevalence of MASD and PU should be investigated simultaneously (Campbell et al., 2016b) and this may give an increased awareness and true distinction between MASD and PU (Johansen and Bredesen, 2019). However, few studies have investigated MASD among ICU patients (Tayyib and Coyer, 2017) and it is still not common to combine MASD and PU studies. In this study, MASD was investigated simultaneously to the International PU one-day point-prevalence study DecubICUs (European Society of Intensive Care Medicine, 2019).

Aim of the study

The aim of this study was to investigate the prevalence of MASD and describe associated factors among Norwegian ICU patients. MASD in this study was categorised as IAD or MASD other than IAD.

Methods

Study design

This multi-centre one-day point-prevalence was carried out 15th May 2018, simultaneously with the ESICM worldwide DecubICUs study on PU (European Society of Intensive Care Medicine, 2019).

Sample and setting

Norwegian ICUs were recruited via the Norwegian Intensive Care Registry (NIR) and an ICU-nurse-network within the South-Eastern Norway Regional Health Authority. Additionally,

heads of ICU departments were contacted directly by one of the authors. All adult patients ≥ 18 years present in the participating ICUs at 08:00 on the 15.05.2018 were invited to participate.

Ethical approval

The study was approved by The Regional Ethics Committee (2017/2433-12017/2433-6) and by the head of each ICU ward. Patient participation was voluntary and the study was conducted according to the principles of the Declaration of Helsinki (World Medical Association, 2013). Written informed consent was obtained from patients or their relatives. The written information outlined the right to withdraw from the study by August 7th before the code list with patients' ID was deleted on August 8th 2018.

Data collection

Each ICU appointed a coordinator for the study. Prior to the study, coordinators and nurses involved in skin inspection and data collection were provided with e-learning and pictures illustrating MASD and PU. Skin inspection was carried out in connection with daily bed baths and the coordinators were available for surveillance on skin observations.

Information on age, gender, type of admission, mechanical ventilation on admission or not, and beds occupied in the ICUs on the study day were collected electronically to the DecubICUs study and used in our study. Additional data was collected on a separate study sheet at the bedside. These data involved IAD and MASD other than IAD located on either the pelvic area, abdomen, thorax, armpits and other, stools, urostomia, ileo- or colostomia, incontinence, use of incontinence devices/products and care plans for prevention and treatment of IAD and MASD other than IAD. IAD was classified in accordance to The Ghent Global IAD categorisation tool (Beeckman et al., 2017). This point prevalence collected patient data from the last 24 h of patients' ICU stay, except for the admission information.

In this study, the prevalence of IAD was calculated among all patients included ($n = 112$) and among patients ($n = 48$) with risk of getting urine (1) or faeces (47) onto their skin on the study day. The prevalence of MASD other than IAD was calculated among all patients included in the study.

Data analysis

Data was analysed with SPSS version 26 (Statistical Package for Statistical Software for Windows, Armonk, New York). Descriptive statistics with frequencies and percentages are provided for categorical data and mean with standard deviation (SD) or median and interquartile range (IQR) as appropriate for continuous variables. Comparison of means was performed with T-tests and comparison of proportions with Chi-square tests. A P-value of <0.05 was considered statistically significant.

Results

Participants

Out of the 25 ICUs across Norway participating in DecubICUs, 23 ICUs provided additional data to this study; 14 from university- and 9 from non-university hospitals. On the study day, a total of 158 beds were occupied in the 23 ICUs, of which 112 ICU-patients finally participated in this study.

Demographic data and type of admission for the ICU patients is presented in Table 1. Significantly more surgical (62%; 37/60) than medical (35%; 18/52) patients were mechanically ventilated on

Table 1
Patient characteristics (n = 112).

		Total (n = 112)	Medical (n = 52)	Surgical (n = 60)
Age (Range 19–85 years)	Mean (SD)	62 (±16)	63 (±16)	61 (±17)
Days in ICU on study day (Range 0–71)	Median (IQR)	3 (1, 9.8)	2.5 (1, 9.0)	4 (1,10.5)
Gender (male)	n (%)	80 (71)	33 (64)	47 (78)
Mechanical ventilation on admission	n (%)	55 (49)	18 (35)	37 (62)

SD; Standard deviation, IQR; Interquartile Range.

admission. No statistically significant difference in age, gender or length of stay was found between medical and surgical patients.

Prevalence of IAD and MASD other than IAD

Overall, 13% (15/112) of patients had some type of MASD (Table 2). One patient had both IAD and MASD other than IAD, explaining the 16 cases in this study (Table 2).

IAD was reported in 5% (6/112) of the patients, and 8% (4/48) of patients at risk of getting urine (1) or faeces (47) onto the skin on the study day. Of those 15 patients not having an indwelling urinary catheter, urinary incontinence was reported in one patient. This patient did not have reported IAD or MASD other than IAD.

The majority of the patients with IAD had liquid/semi liquid stools on the study day (4/6), were male (5/6), medical patients (5/6), and did not receive mechanical ventilation on admission (5/6). Length of stay varied from 1 to 32 days. Three (3/6) patients with IAD had a faecal catheter. None of the patients with an external faecal collector had IAD.

MASD other than IAD was reported in 10 cases (9%). These patients were mainly male (7/10), surgical patients (8/10) and mechanically ventilated on admission (7/10). Length of stay varied from 2 to 59 days. The predominating location reported was the pelvic area (7/10), and the remaining three cases were registered on breasts, armpits and one was unspecified.

In nine cases, ICU nurses reported being insecure or provided the study with missing data on MASD (Table 2) and categorisation of IAD in accordance with The Ghent Global categorisation tool (Beeckman et al., 2017) was inadequate on several data sheets.

Stools

Overall, 42% (47/112) of the patients in this study had stools, of which the majority had liquid stools (89%, 42/47) (Table 3).

The prevalence of liquid or semi-liquid stools was significantly higher in patients mechanically ventilated on admission compared to those not mechanically ventilated (52% vs 29%), whereas no differences was observed between medical and surgical patients, gender or age. The prevalence of liquid or semi liquid stools increased however significantly with length of stay ($p = 0.001$). Thirteen patients with liquid or semi-liquid stools had a stoma (13/42).

Products worn to manage urine and faeces

Overall, 87% (97/112) had an indwelling urinary catheter. Surgical patients had a higher prevalence of urinary catheters (93%, 56/60) than medical patients (79%, 41/52, $p = 0.025$).

Table 2
Cases of IAD and MASD other than IAD (n = 112).

	N	%	Insecure	Missing
Patients with MASD	15	13.4		
MASD cases other than IAD	10	8.9	4	1
IAD cases	6	5.4	1	3

MASD; Moisture Associated Skin Damage.
IAD; Incontinence Associated Dermatitis.

Urostomia was reported in 2% (2/112) and an ileo- or colostomia in 13% (15/112) of the patients.

Overall, 11% (12/112) had a faecal management system. The faecal management systems involved five rectal catheters and seven external faecal collectors around the anus. All patients who had a faecal management system also had a urinary catheter ($n = 12$). Of those patients offered a faecal management system ($n = 12$), almost all had liquid or semi-liquid stool (92%, 11/12).

Incontinence briefs were worn by 43% (48/112) of the total population, of which 77% (37/48) also had underpads in bed. Of those patients present with a urinary catheter, 47% (46/97) had incontinence briefs, and 36% (35/97) had both incontinence briefs and underpads. The majority (80%, 28/35) of patients who had a combination of urinary catheter, incontinence briefs and underpads had liquid/semi liquid stools, justifying the use of incontinence products.

For the patients who had both a urinary catheter and a faecal management system ($n = 12$), the majority (83%, 10/12) had incontinence briefs and underpads (80%, 8/10).

Care plans for prevention and treatment of MASD

Overall, few care plans for prevention ($n = 12$) and treatment ($n = 4$) of MASD existed. In this study, 34 patients with liquid/semi liquid stools had no care plan for prevention of IAD. Only one patient with IAD (1/6) and one with MASD other than IAD (1/10) had a care plan for treatment.

Discussion

In this study, 13% of all patients had reported some type of MASD. IAD was reported in 8% of patients at risk of getting stools or urine onto the skin on the study day. Compared to previous studies showing IAD prevalence from 21 to 95% (Bliss et al., 2011; Coyer and Campbell, 2018; Johansen et al., 2018; Valls-Matarín et al., 2017; Wang et al., 2018), the prevalence was low. El-Soussi and Asfour (2017) indicates that ICU nurses may prioritise respiratory care above skin care, however, the findings from this study indicates that skin care is prioritised. Patient hygiene, focusing on basic elements of care, should be in the forefront of critical care nursing (Burns and Day, 2013; El-Soussi and Asfour, 2017) and according to Bayón García et al. (2012), nurses in ICUs across Europe acknowledged the risk of skin breakdown in patients with diarrhea. In Norway, most ICUs have a 1:1 nurse-patient ratio and the majority of nurses have 90 or 120 ECTS (European Credit Transfer and Accumulation System) postgraduate or master's qualification in ICU Nursing (Johannessen et al., 2011; NSFs

Table 3
Type of stools (n = 112).

	N	%
Liquid/semi liquid	42	37.5
Formed	5	4.5
No stools	56	50.0
Missing	9	8.0

landsgruppe av intensivsykepleiere, 2015; Stafseth et al., 2011). These highly qualified ICU nurses work primarily bedside and much time is spent on hygiene and mobilisation (Stafseth et al., 2011). When qualified nursing is combined with patient centered care, a significant difference can be made to patient safety (Chamberlain et al., 2018). Interestingly, the comparatively low prevalence of skin breakdown existed despite an almost absence of care plan for prevention and treatment. Therefore, ICU nurses' qualification, direct patient care and high nurse-patient ratio may partly explain the prevalence of skin breakdown in this study.

Basic nursing involving skin care and mobility can improve patient outcome and ensure patient safety (Vollman, 2013). However, according to Bayón García et al. (2012) it might take 20 min, with 2–3 nurses for each episode of loose stools, making it highly resourceful. Indeed, the findings from this study may indicate that despite high workload often found in ICU units, Norwegian nurses have the competency and time available to offer best practice skin care.

Although liquid or semi liquid stools are not associated with a particularly high prevalence of skin breakdown in this study, as it may be in other acute care settings (Campbell et al., 2016a), it is useful to dwell on this finding. Although this study focused on skin breakdown, it is important to consider how liquid or semi liquid stools may for example contaminate patients' environment and increase the risk of infections and cross-contamination (Bayón García et al., 2012). Indeed, handling liquid stools may not only be of concern for skin integrity, nursing resources and risk of infections, but of concern to the energy-intensity and frequent interruptions it gives to critically ill patients. Repetitive personal hygiene because of liquid stools may be time consuming and energy-intensive for ICU patients and therefore increase the risk of respiratory and circulatory instability, increased need of analgesia, reduced time and energy for rehabilitation and interrupted sleep (McFeely, 2016), psychological disturbance and prolonged stay in the ICU. The prevalence of loose stools found in this study should therefore be investigated further.

The overall low prevalence of skin breakdown combined with high prevalence of liquid and semi-liquid stools may be explained by the fact that many patients did not have stools, many had urinary catheters, stoma and faecal management systems avoiding that urine and/or faeces affected the skin. In a study that found IAD in 10% of the population in an acute care setting in Australia, only 13% had urinary catheter, none had a faecal management system and incontinence briefs were mostly used for incontinence control (Campbell et al., 2016a). In their study, 24% were urinary- and 12% double incontinent, leaving patients likely to get urine and faeces on their skin. Although incontinence briefs were used for many patients in our study, they were often combined with urinary catheters and a faecal management system. These patients would only get urine and faeces on the skin if these systems failed. When a urinary catheter, a faecal management system, incontinence briefs and underpads are used together, the risk of IAD is small. Indeed, this combination of incontinence products may have contributed to a moist environment in the pelvic area and explaining the findings of MASD other than IAD primarily in this body area.

In this study, three patients with IAD had a faecal catheter whereas none of those offered an external faecal collector had IAD. Intra-rectal catheters should actually effectively protect the perineal area from skin breakdown (Whiteley and Sinclair, 2014). The presence of IAD, together with faecal catheters, may therefore indicate that these catheters were put in place after IAD occurred. Although this study found no IAD in combination with external faecal collectors, there is a risk that skin breakdown is hidden behind the flange. ICU nurses most likely recognise the challenge with leaking external faecal management systems, their short lifetime and the risk of skin breakdown from leakage of faeces and/or frequent

replacement of the system. According to Whiteley and Sinclair (2014), external faecal collection bags may need two nurses to ensure an adequate flange seal around anus and their wear-time is short. Because of this, they have been discontinued in Australia (Whiteley and Sinclair, 2014). Further investigation into the use of, lifetime and resources involved in changing procedures for external faecal management systems is worth looking into in Norway as they were used on equal terms to faecal catheters.

Loose stools or diarrhoea occur frequently among critically ill patients due to severe illness and care provided (Jack et al., 2010). In our study, the frequency of liquid or semi liquid stools increased with length of stay. These findings are in agreement with an Australian study, however, it should be noted that they only included patients with continuous infusion of tube feeding (Jack et al., 2010). In this study, no information existed on enteral or parenteral feeding or use of antibiotics, making it difficult to discuss related factors. However, because most patients experiencing loose stools in this study were mechanically ventilated and the prevalence increased by length of stay, it is likely that they received tube feeding. From a clinical perspective, bowel management is "low tech" in a "high tech" environment (Dorman et al., 2004), meaning that the problem with liquid or semi liquid stools can be obscured by focusing more on life-threatening conditions. Indeed, with liquid or semi liquid stools in almost all patients that had stools on the study day in this study, a further investigation into the Norwegian ICU population is paramount although it did not affect the skin considerably.

Findings from this study indicate that Norwegian ICU patients' skin is good since they are well looked after by highly qualified ICU nurses. Rather than being concerned about skin breakdown, the high prevalence of liquid or semi-liquid stools should be of concern. Also, it should interest ICU nurses how the focus on skin care due to liquid stools may affect patients' outcomes in terms of frequent interruptions, infections, reduced activity, sleep and length of stay.

Importantly, data on PUs within the same population is still to be published (European Society of Intensive Care Medicine, 2019) and the total skin breakdown is yet to be investigated. Potentially, the presence of MASD other than IAD primarily in the pelvic area can be explained by PU data.

Limitations

This multicentre study has some limitations that should be considered. It is a point prevalence study based on the last 24 hours of patients' ICU stay and therefore reflects a snap-shot of the situation in clinical practice. Because this was a multicentre study, heterogeneity in skin care may exist between units. Further, many ICU nurses participated in data collection and their knowledge was not tested after providing the participating ICUs with e-learning and pictures. This may affect the study results. Due to the high usage of urinary catheters, the prevalence of IAD in this study is most likely caused by faeces. None of the patients had dermatitis around their tracheostomia or wounds and we suspect it may be due to under-reporting. Several important factors were not registered, for example skin care regime, tube feeding and medication. We have no control over how many of the eligible patients participated in the study, but assume that eligible patients are close to the number of beds occupied on the study day. Generalisation of the results of this study must be made with care due to the listed limitations.

Conclusion

This is one of the first Norwegian studies investigating IAD and MASD other than IAD in critically ill patients. Patients in this study

had a high prevalence of loose stools making them vulnerable to skin breakdown but despite this high risk, comparatively few had IAD. The prevalence of skin breakdown may relate to ICU nurses qualifications and staffing. The high prevalence of urinary catheters together with faecal management systems, avoiding urine and faeces contact with the skin, may also explain the low prevalence of skin breakdown.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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