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Prone positioning in acute respiratory failure: survey of Belgian ICU nurses

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Abstract *Objective:* To determine the frequency of use and attitudes towards prone positioning in patients with acute respiratory failure.

Design and setting: Verbal questionnaire survey in all 79 intensive care units in French-speaking Belgium.

Methods: Of the 79 ICUs 29 performed prone-positioning, and 25 agreed to participate in the questionnaire. *Measurements and results:* Nurses at 9 of the 25 hospitals expressed reluctance to use prone positioning. The time schedules associated with prone positioning varied among the units surveyed, with no consensus. Units used two to six members of staff to turn a patient, with three most commonly being employed. Patients were most commonly positioned with both arms above the head and cushions under

the chest, head, and legs, but there was considerable variation among units. The complications most commonly reported were facial edema and decubitus ulcers, with only three of the units reporting accidental extubation. Only two of the units had an established protocol for prone positioning although nurses from 14 of the units felt this would be useful.

Conclusions: Prone positioning is approached with some reluctance by ICU staff. If the use of prone positioning in patients with acute respiratory distress syndrome is deemed worthwhile, discussion and development of departmental protocols may facilitate its use.

Keywords Oxygenation · Questionnaire · Complications · Acute respiratory distress syndrome

Introduction

Prone positioning has been advocated as a possible strategy to improve gas exchange in acute respiratory failure and perhaps facilitate recovery from acute respiratory distress syndrome (ARDS). Indeed, early case reports noting beneficial effects on oxygenation of prone positioning in patients with respiratory failure [1, 2, 3] have been supported by small open clinical trials [4, 5, 6, 7, 8, 9, 10, 11, 12, 13] and by a recent randomized, controlled trial involving 304 patients with acute lung injury or ARDS [14]. Although this recent study [14] failed to demonstrate a positive effect on mortality rates, the convincing effects on oxygenation have led to this technique being applied increasingly in intensive care units (ICUs).

However, as it is a relatively new technique, many practical aspects remain poorly defined, and there is considerable variation in the way in which prone positioning is applied. In addition, a poor understanding of the rationale and potential benefits of this procedure, combined with concerns about risks for the patient and increased workload, may lead to a general reluctance to use the technique, particularly among nursing staff. We investigated nurses' attitudes towards prone positioning in mechanically ventilated patients with ARDS.

Material and methods

All 79 adult ICUs in the French part of Belgium (Wallonie and Brussels) were contacted by telephone to determine whether prone

Table 1 Reasons given by the 50 hospitals that did not practice prone positioning (some gave more than one reason)

Reason	No. of hospitals
No medical prescription	29
Insufficient staffing levels	9
Inadequate equipment	7
Do not know	6
No ARDS patients	4
Elderly or malnourished patients	2
Technique associated with too many complications	2
Technique too complicated	1
Staff refusal	1

positioning was used. If prone positioning was not used, the ICU contact was asked why not. If prone positioning was used, a request was made to visit the unit and for the head nurse or one or two senior nurses to complete a short questionnaire. The questionnaire was divided into two sections, the first related to general features of prone positioning (e.g., indications, timing) and the second related to more specific details (e.g., positioning, monitoring, complications).

Results

Prone positioning was performed in 29 of the 79 ICUs; the reasons why prone positioning was not used in the 50 other ICUs are listed in Table 1. Twenty-five of the 29 ICUs that perform prone positioning agreed to the questionnaire.

The questionnaire revealed that prone positioning was used for refractory hypoxemia in all the ICUs, with 3 units also using the technique to prevent pressure sores. Prone positioning was used early in the course of ARDS in 11 units, later in the course in 5 units, and as a last resort in 9 units. Prone positioning was sometimes used in combination with inhaled nitric oxide, inverse ratio ventilation, or high frequency ventilation. There was considerable variation in the definitions used to determine whether a patient had responded to prone positioning, with 8 hospitals requiring radiological evidence of improvement in addition to blood gas improvement.

Nurses in 9 of the 25 units expressed considerable reluctance to the concept of prone positioning: The principal reasons for this reluctance were lack of knowledge about the procedure, fear of complications, increased workload, and difficulty in performing maneuvers. When asked how many individuals were required to turn the patient, estimates varied from two to six with a maximum (8 ICUs) of three persons. The patients were usually kept on their standard bed (24/25 units) although the occasional use of a Striker bed was indicated by some.

The time schedules associated with prone positioning varied considerably (Table 2). Contraindications to prone

Table 2 Usual time schedule for prone positioning (open question) in the 25 ICUs

Frequency/day	Duration (h)	No. of ICUs
4 times	3–4	2
2 times	4	2
2 times	6	2
2 times	4–6	2
1–2 times	3–5	2
3 times	2	1
2 times	3	1
4 times	2	1
3–4 times	6	1
1–2 times	6	1
1 time	6–8	1
3 times	1	1
3–4 times	6–8	1
1 time	6–12	1
1 time	8–12	1
3 times	4	1
Overnight	–	1
Variable depending on the patient	–	3

Table 3 Usual contraindications to prone positioning stated by the nurses surveyed

Contraindication	No. of ICUs
Hemodynamic instability	17
Intracranial pressure monitoring	10
Abdominal surgery/drains	7
Renal replacement therapy	7
Facial/cervical trauma	5
Obesity	2
Thoracic drain	1

Table 4 Precautions felt by the nurses surveyed to be necessary before turning the patient to prone: no. of ICUs

	Necessary	Not necessary	Do not know
Stop nasogastric feeding	13	10	2
More frequent tracheal aspirations	18	4	3
Change in ventilator mode	12	12	1
Careful eye care	17	5	3
Evaluation of gastric residual	8	14	3
Increase FIO ₂	8	15	2
Use of special skin cover	5	15	5

positioning stated by the nurses are listed in Table 3 and any special precautions in Table 4. In all ICUs patients were intubated and sedated; muscle relaxants were commonly used in 6/25 ICUs. Positioning used during the technique is presented in Table 5, and the complications encountered in Table 6.

Only 2/25 ICUs had a protocol for prone positioning, but nurses from 14 of the 25 ICUs felt that a protocol would be useful.

Table 5 Usual patient position when prone as stated by the nurses surveyed

	No. of ICUs
Arm positioning	
Both arms above head	13
One arm above head, one arm by side	4
Arms either above head or by side	4
Both arms by side	3
Both arms above head, or one above head, one by side	1
Cushions	
Under the chest	18
Under the head	14
Under the legs	12
Under the pelvis	9
Under the knees	1
Under the genitalia	1
Between the legs	1
No cushion	1
Do not know	1

Table 6 Principal complications stated by the nurses surveyed as having been encountered by them whilst turning a patient or during the prone position period

Complication	No. of ICUs
Facial edema	23
Decubitus ulcers	14
Cardiorespiratory arrest	7
Extubation	3
Joint complications	2

Discussion

Although first proposed more than 20 years ago, it is only over the past few years that prone positioning has begun to be used with any frequency in the ICU. However, there is little consensus about the practicalities of prone positioning, including how often and for how long patients should be placed prone, and concerns about moving a critically ill patient and dislodging vital tubes and catheters may restrict its use.

Prone positioning results in improved regional ventilation by a variety of mechanisms including a reversal of gravitational forces and reduced pleural pressure gradients [15]. This, in addition to a more uniform lung perfusion [16], results in better ventilation/perfusion matching, and improved oxygenation [17, 18]. In animal models of lung injury prone positioning also results in less histological damage [19]. Despite the evidence in favor of prone positioning our survey shows that only 29 of the 79 ICUs in French-speaking Belgium use the technique. While in some of the ICUs this may be due to inappropriate patient populations, the reasons expressed suggest some degree of reluctance by the staff. Even in

ICUs using prone positioning, only 11 of the 25 ICUs used the technique early in the course of ARDS, with 9 units reserving it for use as a last resort. However, to have most effect, prone positioning should probably be used early, as the more advanced the fibroproliferative phase of ARDS, the less compliant the lung is and the less responsive to positional changes.

Perhaps not surprisingly, the practicalities of prone positioning varied extensively from one ICU to another, in particular the number of times the patient is turned to prone, and the duration of such periods. Precise recommendations regarding these aspects are lacking. The recent study by Gattinoni et al. [14] used a protocol of placing patients prone for a continuous period of at least 6 h a day for 10 days, but other groups have employed other approaches [4, 5, 6, 7, 8, 9, 10, 11, 12, 13], with no real consensus as to the optimum periodicity or duration [20].

As with time schedules for prone positioning, data related to the optimal position for a patient when prone are also scarce and may require further study. Our survey revealed considerable variability in both the technique used to move the patient and the final position used. Several studies have used rotating [1, 2] or air suspension [8, 11, 21, 22] beds, but the majority of units in our survey used a standard ICU bed. Prone positioning is a team effort, requiring at least three members of staff to ensure a smooth procedure with a minimum of disruption to the patient [20, 23]. Not all studies report the exact technique for turning patients, but those that do use a minimum of four attendants, these being mainly nursing staff, usually with a physician present, and sometimes a respiratory therapist [8, 9, 10, 13, 24]. The majority of the units surveyed in our study used three members of staff, although figures ranged from two to six, and just 12 units required a physician to be present.

Cushions, pillows, and protective pads have been placed in various positions to avoid restriction of abdominal and diaphragmatic movement [3, 4, 8, 12, 13], and to prevent pressure sores [9, 10]. While there is no overall consensus on the correct placement of supporting cushions or pads, placing the patient with one arm above the head and the other by the patient's side, with the patient's face turned away from the raised arm reduces the risks of damage to the brachial plexus and surrounding nerves [25]. Importantly, patients should not be left in any one position for prolonged periods of time and alternating positions for consecutive prone trials is recommended [23, 25].

Various complications have been reported in patients nursed prone, the most frequent, as noted by the nurses in our survey, being facial edema and skin and mucosal damage to the chest, forehead, tongue, and lips [9, 11, 14, 24]. Dislocation of tubes, including arterial catheters and the endotracheal tube, has been reported although occurs rarely [12, 14]. Other potential complications in-

clude corneal ulceration [8] or blindness due to orbital pressure, peripheral nerve injury associated with turning or poor positioning, cervical cord injury from hyperextension, and hypotension due to inferior vena cava compression [17].

There are few absolute contraindications to prone positioning, but clearly patients with unstable spinal injuries should not be turned, and those with unstable cardiac rhythm who may require cardiac compression of defibrillation should also be nursed supine [17]. Open chest or abdominal wounds, uncontrolled intracranial hypertension, advanced pregnancy, and severe facial trauma have also been listed as contraindications [17, 23], and one group reports breast necrosis in a patient with silicone breast implants and suggests that particular care be taken if placing such patients prone [26].

We acknowledge that the present study has its limitations. The questionnaire was not systematically addressed, and although we tried to identify nurses who could best address the questions posed, it is possible that on the day of the interview, key staff were not available. Additionally, the results must be interpreted with the pri-

mary aim of the study in mind. The questionnaire was not designed to obtain precise numbers and exact details, rather to gather general information and perceptions regarding the use of prone positioning in Belgian ICUs. As such, we believe the results provide an overview of the way in which prone positioning is practiced in Belgium, and a valuable indication of the general feelings of nursing staff toward the technique.

There are clearly many unanswered questions related to prone positioning in ARDS, and, as shown in our survey, there is little consensus regarding the technique and timing for placing patients prone. The study also identifies considerable reticence among ICU nursing staff towards the use of prone positioning. Clearly there are complications associated with its use, but anticipation of these problems and careful attention to detail during the process can minimize the risks [24]. If prone positioning is used, staff awareness of, and familiarity with, the technique need to be encouraged. This simple study provides important initial information, which can help focus training programs and promote the development of local and national nursing protocols for prone positioning.

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