Epidemiology and prognoses in a medical intermediate care unit

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BACKGROUND

The purpose of medical intermediate care units is the observation and treatment of patients with incipient or manifest organ failure. We wished to obtain data on which conditions result in admission to these units and the prognosis for these patients.

MATERIAL AND METHOD

All patients admitted to the medical intermediate care unit at Akershus University Hospital in 2014 were registered prospectively with reason for admission, period of hospitalisation, degree of severity, comorbidity, last place of hospitalisation prior to medical intermediate care and treatment limitations (do-not-resuscitate order and/or do-not-intubate order). Mortality in the hospital and one year after hospitalisation were registered retrospectively. Multiple regression analysis was performed with hospital mortality as the outcome variable.

RESULTS

Altogether 1369 patient hospitalisations for 1118 unique patients were included. The most frequent reasons for admission were pneumonia, chronic obstructive pulmonary disease, sepsis, poisonings and hyponatraemia. The degree of severity of the condition for which patients were admitted corresponded to that reported by intensive care departments in Norwegian local hospitals. A total of 13 % died during their stay in hospital and a further 14 % in the course of one year. The highest mortality was for patients with severe infection, congestive heart failure and restrictive/neuromuscular respiratory disorder. The degree of severity, age, infection, comorbidity and ward as admitting unit were predictors of mortality during the hospitalisation period. Risk-adjusted mortality ratio of 0.64 satisfied the quality objective for intensive care departments (<0.7). A total of 5.6 % of hospitalisations in the medical intermediate care unit entailed transfer to the intensive care ward.

INTERPRETATION

The degree of severity of the condition for which patients were admitted was high, and the treatment outcomes judged upon expected mortality were good. Medical intermediate care units can relieve pressure on wards with seriously ill patients without taking up intensive care beds.

Patients who need monitoring or treatment beyond what can be provided in normal wards, but do not require the resources of the intensive care unit, are often referred to as intermediate-care patients. An ageing population and high expectations for diagnostics and treatment, including for patients with an underlying life-shortening disease, mean that this is a growing patient category.

At the medical intensive care unit, Oslo University Hospital Ullevål, positive experience has been gained from using a medical intermediate care unit for this patient group (1). Such units may relieve pressure on both intensive care units and wards (2).

In 2013, Akershus University Hospital established a medical intermediate care unit. In this article we will give an account of our experience with this unit, with an emphasis on presenting epidemiological and prognostic data.

Material and method

This was a prospective cohort study that included all patients who were admitted to medical intermediate care at Akershus University Hospital in 2014. It was submitted to and approved by the hospital's data protection officer (case no. 13–062), who deemed it a quality assurance study. Hence, it was not submitted to the Regional Committee for Medical and Health Research Ethics.

Akershus University Hospital serves as an emergency hospital for approximately 500 000 people. The medical intermediate care unit has ten beds and receives patients mainly from the emergency unit and internal medicine wards. The unit has a six-part roster of senior consultants who are specialists in internal medicine or anaesthesiology and

responsible for daily activities, including on weekends. After 09.00 p.m., an experienced specialty registrar is on duty.

The key admission criterion is an unstable condition that may quickly require respiratory support with non-invasive ventilation or circulatory support with vasoactive drugs, or another unstable condition, for example electrolyte imbalances. There are no formal admission criteria. A transfer to medical intermediate care is decided by the doctor on duty in consultation with the doctor on the ward, almost invariably after a joint assessment of the patient.

Most patients with respiratory failure are provided with non-invasive ventilation support. Ventilation therapy may be provided in case of short-term need, such as poisonings. Intermittent dialysis can be provided as needed. The hospital also has an intermediate cardiac unit (eleven beds) and an intermediate neurological unit (four beds). However, heart patients who need non-invasive ventilation support and close follow-up will often be transferred to the medical intermediate care unit because of its higher nurse-to-patient ratio. The same applies to patients with neurological disorders who have threatened airways or need non-invasive ventilation support.

Because of its proximity to the operating theatre, the post-operative unit is used for medical patients who have unstable gastrointestinal haemorrhages and high need for transfusions, but they are transferred to the medical intermediate care unit after endoscopy and stabilisation.

The medical intermediate care unit also helps relieve pressure from the wards of patients with multiple issues and a high need for care, and receives patients from the intensive care unit who are deemed too ill to be transferred directly to a ward.

DATA COLLECTION

Patient data were continuously registered in the patient records system MetaVision (version 5.45.062, 2007, iMDsoft). The following variables were registered: location in the hospital prior to admission to the intermediate care unit, cause of admission as defined by APACHE III (3), age, period of stay in intermediate care, degree of seriousness of the cause of admission rated by a SAPS-II score, comorbidity before the admission in question as measured by Charlson's comorbidity index, restrictions on treatment, if any (a do-not-resuscitate order or do-not-intubate order), as well as death during hospitalisation and death within one year. Data on death after discharge were retrieved from the vital register.

The causes of admission were categorised according to the same system as in the APACHE III rating system, with minor adaptations. For patients with chronic obstructive pulmonary disorder (COPD) with verified pneumonia, the disease was scored as COPD when obstructivity was the dominant symptom. Pneumonia with sepsis was coded as pneumonia when respiratory failure was the dominant symptom, but as sepsis if unstable circulation was the most prominent feature.

Since intensive-care patients can rarely be categorised with a single diagnostic code, the list of causes in APACHE III is often used to describe the patient population in intensive care units. It is easier to use than the ICD-10 coding system and has been used with some modifications in Norwegian and Swedish intensive care units for nearly 20 years. Charlson's comorbidity index weights 16 diagnostic groups, such as congestive heart failure, chronic pulmonary disease, diabetes and cancer, with point scores, where the sum of the scores predicts the risk of mortality (4).

With the aid of a SAPS-II rating, which is used in intensive care units, mortality risk during hospitalisation is estimated on the basis of 17 biochemical and physiological variables registered during the first 24 hours of the stay in intensive care (5). The higher the score, the higher the degree of seriousness of the acute disease. The scale is non-linear and ranges from 0 to 163 in theory, although scores above 80–90 are extremely rare. Each score on the scale is associated with a likelihood of mortality during the hospitalisation period. In 2014, the

average SAPS-II score in Norwegian intensive care units was 38.

The standardised mortality ratio (SMR) is the ratio between the observed hospital mortality and expected average mortality estimated on the basis of SAPS-II. Values below 1 indicate a lower mortality than expected. The standardised mortality ratio was estimated for all patients in total and for patients from emergency units and wards. A value below 0.7 is a target quality indicator in Norwegian intensive care units (6).

STATISTICS

Descriptive statistics with percentages and averages are used for continuous variables. Multiple regression analysis was undertaken with hospital mortality during the patient's first stay as the outcome variable, and SAPS-II score, age, comorbidity according to Charlson's index, infection diagnosis and location in the hospital prior to the admission as explanatory variables. Gender was also included in the analysis but was later removed from the model, since it had no significant effect.

The data set contains a considerable number of diagnosis-related variables, but with the exception of infections, these were excluded from the analysis in order to reduce the risk of random spurious findings. The analyses were undertaken with the aid of SPSS version 23.

Results

Altogether 23 514 admissions were registered as arriving via the emergency unit to the medical department of Akershus University Hospital in 2014, whereof 1 473 cases (6.3 %) were treated in the intermediate care unit. We excluded 82 patients (5.6 %) who were transferred to the intensive care unit and 22 patients (1.5 %) who were initially admitted to the intensive care unit and later transferred to intermediate care.

A total of 155 patients had multiple admissions – 251 hospitalisations in total. Thereby, 1 369 hospitalisations encompassing 1 118 patients were included in the analyses. The youngest patient was 15 years old, the oldest was 99; average age was 64.2 years. 67 % of the patients were older than 60 years, and 47 % were women.

Causes of admission ranked by frequency and mortality in the groups are described in Table 1. Non-invasive ventilation support was provided in 32 % of the cases, for 2.1 days on average. A SAPS-II rating was done for 936 of 1 118 patients (84 %). Those who were not rated had either too short hospitalisations with data missing or were younger than 18 years.

Table 1

The ten most frequent causes of admission to medical intermediate care in 2014 and mortality during and after the hospitalisation period

Causes	Number of patients	Died in hospital (%)	Died within 1 year (%)
Pneumonia	154	27	18
COPD	145	10	14
Sepsis	127	15	20
Poisoning	122	0	5
Hyponatraemia	105	9	13
Gastrointestinal haemorrhage	49	16	14
Other respiratory conditions[1]	44	27	16
Congestive heart failure	37	24	19
Rhabdomyolysis	31	0	3
Ketoacidosis	28	0	4
Other[2]	276	13	14

[1]E.g. restrictive disorder, neuromuscular disease

[2]E.g. pulmonary embolism, acute renal failure, myocardial infarction, seizures, other metabolic diseases

Hospitalisation time, average age, mortality, SAPS-II score and standardised mortality ratio after admission from the emergency unit and ward respectively (92 % of the patients) are shown in Table 2. Those 8 % who have been omitted from the table constitute a heterogeneous group admitted from the post-operative unit, cardiac observation ward, neurological observation ward or other hospitals.

Table 2

Mortality, hospitalisation time, age, SAPS-II score (simplified acute physiology score) and standardised mortality ratio (SMR) for 1 033 patients admitted to medical intermediate care in 2014 from the emergency unit or ward. The remaining patients were a heterogeneous group admitted from the post-operative unit, cardiac observation, neurological observation or other hospitals

Admitted from	Emergency unit	Ward
Number	720 (64 %)	313 (28 %)
Died during hospitalisation	66 (9 %)	72 (23 %)
Average time in intermediate care (d)	1.6	1.9
Average age (years)	62	70
SAPS-II scored	615 (85 %)	262 (84 %)
Average SAPS-II	32	38
Mortality expected from the SAPS-II score	18 %	26 %
Observed deaths among those scored	55 (9 %)	55 (21 %)
SMR (observed/expected mortality)	0.49	0.82

The standardised mortality ratio for medical intermediate care overall was 0.64. The diagnostic groups that had a higher hospital mortality when admitted from the ward than from the emergency unit were sepsis (23 % versus 9 %), cardiovascular conditions (33 % versus 15 %), respiratory conditions except COPD (27 % versus 14 %) and pneumonia (35 % versus 21 %).

Altogether 5.4 % of the patients were readmitted to intermediate care during one and the same hospitalisation period (target quality indicator < 4 %). A diagnosis of COPD exacerbation was the most frequent cause of readmission; this was the case both for admissions during the same hospitalisation period (2–6 admissions) as well as for admissions during different hospitalisation periods (2–12 hospitalisations). Average hospitalisation time for patients with only one admission to medical intermediate care was 9.4 days.

Table 3 shows mortality by comorbidity. Of 93 patients with infections and Charlson's index 0, altogether 11 % had died within one year. Of 804 patients with a Charlson's score > 0, the cause of admission was related to underlying chronic disease in 61 %.

Table 3

Mortality grouped by comorbidity according to Charlson's index in patients admitted to medical intermediate care in 2014

Charlson's index	Number of patients	Died in hospital (%)	Died within 1 year (%)	Total deaths (%)
Charlson's 0	314	2.6	3.8	6.4

Charlson's index	Number of patients	Died in hospital (%)	Died within 1 year (%)	Total deaths (%)
Charlson's 1	267	11.2	10.1	21.3
Charlson's 2	226	15.0	18.6	33.6
Charlson's ≥ 3	311	24.8	23.5	48.2

For 26 % of the patients, treatment restrictions (a do-not-resuscitate and/or a do-not-intubate order) were in effect for all or part of their stay in medical intermediate care. The restriction was decided in consultation with the patient/next of kin by the doctor in the referring ward or by a doctor in the intermediate care unit, most often after a joint deliberation. The restrictions tended to apply to patients who were elderly with significant comorbidity. For patients older than 80 years, restrictions applied to 50 %. For those with a Charlson score ≥ 3, restrictions applied to 48 %. A total of 57 % of all patients with treatment restrictions were discharged alive, and 35 % were still alive one year later.

Table 4 shows the results of a regression analysis of deaths during hospitalisation. SAPS-II, age, having an infection as part of the total illness, comorbidity measured by Charlson's index and having been admitted from a ward were all significant predictors of death. Age is an independent predictor as well as included in the SAPS-II score. Of 969 patients who were discharged alive in 2014, 73 % were alive one year later. For those who died within one year, the median time until death was 82 days (interquartile range 19–222 days).

Table 4

Regression analysis with hospital mortality as the outcome variable and age, SAPS-II score, Charlson's index and last location in the hospital as explanatory variables

Variable	Type	Unadjusted effects			Adjusted effects		
		P-value	Odds ratio	95 % confidence interval	P-value	Odds ratio	95 % confidence interval
Age	Numerical value	0.000	1.06	(1.04–1.07)	0.004	1.03	(1.01–1.05)
Infection	No (ref.)		1				
	Yes or suspected	0.000	3.78	(2.37–6.04)	0.013	1.94	(1.15–3.28)
SAPS-II	Numerical value	0.000	1.10	(1.08–1.12)	0.000	1.06	(1.06–1.10)
Charlson's index	Numerical value	0.000	1.35	(1.28–1.47)	0.040	1.12	(1.01–1.25)
Admitted from	Reception (ref.)		1				
	Ward	0.000	2.71	(1.80–4.06)	0.037	1.64	(1.03–2.60)
	Other[1]	0.119	1.83	(0.86–3.93)	0.086	2.12	(0.90–5.02)

[1]Postoperative unit, cardiac observation, neurological observation or transferred from other hospitals

Discussion

Patients are primarily admitted to medical intermediate care units because of incipient or manifest organ failure. The main objective of this study has been to identify the conditions that have produced this organ failure and to investigate the short-term and long-term prognosis for this patient group. With a catchment area that encompasses nearly 10 % of Norway's population, our findings are likely to be generally valid and of value to hospitals that already have or are planning to establish a medical intermediate care unit.

In our study, the most frequent causes of admission were pneumonia and COPD exacerbation, the latter most likely caused by an infection. These were followed by sepsis, and infections were thus the dominant cause of admission. A high proportion of patients were admitted with poisonings, although many poisonings were treated in a ward with opportunities for telemetry. However, patients with poisonings admitted to intermediate care will need observation because of respiratory depression or a low level of consciousness.

The large number of patients with hyponatraemia in our study most likely represented an insufficient capacity for frequent blood tests/follow up in the wards, more than a need for medical intermediate care. At Akershus University Hospital, all patients with an s-Na below 120 mmol/l are considered for correction in an intermediate care unit.

With an average SAPS-II score of 34, the degree of seriousness of the acute illness was considerable. In comparison, Norwegian intensive care units as a whole had an average SAPS-II score of 38 in 2014 (6). A SAPS-II score of 34, however, is identical to the one found for intensive care units in local hospitals (6).

The populations were similar also in terms of age – the average age in medical intermediate care units was 64.2 years, compared to 65.5 years in intensive care units in local hospitals (6). There was a high degree of comorbidity, with 311 patients having a Charlson score ≥ 3, and approximately one-half of the cohort had a score ≥ 2.

Despite the fact that the degree of seriousness of the cause of admission was the same as the one reported from intensive care units in local hospitals, the hospitalisation time was shorter – median time was 1.25 days and the average 1.7 days, compared to a median time of 1.7 days and an average of 2.7 days (6). Efficient management and the fact that transfers to the wards were undertaken during the night is one possible explanation.

The proportion of readmissions amounted to 5.4 %, however, which is above the target of 4 %. The rate of readmissions to the intensive care unit, on the other hand, declined from 7.8 % in 2012 to 5.3 % in 2014 (6, 7). The reason may be that the medical intermediate care unit treats some patients that otherwise would have needed a bed in the intensive care unit, and that the intensive care unit transfers patients to intermediate care when they need beds. Only 5.5 % of the patients needed to be transferred to intensive care, indicating that many who are otherwise treated in intensive care units could have been attended to at a lower level of care.

The prognoses during and after a stay in medical intermediate care depended on the cause of admission. Patients with infections, congestive heart failure and restrictive/neuromuscular pulmonary disorders had the poorest prognoses, both while in hospital and after one year. Although infections are regarded as potentially transient and curable conditions and therefore given particular emphasis in prognostications and decisions on treatment restrictions, an infection was an independent predictor of hospital mortality in our population (Table 4).

The mortality observed after a stay caused by an infection was higher than would be expected in light of Charlson's index. Of those patients who had an infection or suspected infection and Charlson's index 0, altogether 11 % had died within one year. This is above average for the Charlson's index 0 group as a whole (6.4 %). Another study (8) also found higher mortality after a serious infection, which may be due to an underlying disease or that factors that predispose for infections also predispose for higher mortality.

There was no hospital mortality for patients who had been admitted for poisonings, but the one-year mortality rate of 5 % is disquieting and underscores the risk of early death in this patient group.

There was a significant difference in mortality among patients admitted from the ward and the emergency unit respectively. This tallies with findings made by a previous study of 53 % versus 30 % for patients admitted to an intensive care unit from a ward and an emergency unit respectively (9). The stay in intensive care was also significantly shorter for those who

were admitted from the emergency unit.

Decompensation in the ward is an independent predictor of death (10, 11). The poorer prognosis for patients admitted from the ward may be due to the effect of delayed intervention. An alternative explanation is that the populations are different, and that patients hospitalised in wards are transferred to medical intermediate care because of a new condition or complication in addition to the disease for which they were primarily admitted.

The causes of admission that had the poorest prognoses in general were pneumonia, sepsis and congestive heart failure, but these diagnoses also had the greatest difference in mortality between admissions from the emergency unit and the ward respectively. These diagnoses may also involve complications for patients on a ward.

Using our source data and study design, we are unable to quantify the contributions made by different patient groups, new complications and delayed interventions, if any, to the difference in mortality observed in admissions from the emergency ward and the ward respectively. However, the difference in standardised mortality ratio was significant and indicates that in case of doubt as to whether a patient needs to be placed in medical intermediate care or not, the initial location ought to be intermediate care, rather than attempting the loop via a ward.

During the stay in intermediate care, 26 % of the patients had recorded a do-not-resuscitate and/or a do-not-intubate order. This decision was partly made on the ward or during a previous stay in a hospital/nursing home, but it was also made temporarily or situationally when attempting cardiopulmonary resuscitation was deemed useless at a critical treatment stage. We have no figures for the number of situationally dependent restrictions that were lifted after survival of a critical stage.

Altogether 35 % of the patients for whom treatment restrictions had been decided were still alive after one year. Thus, treatment restrictions do not necessarily mean that treatment has been abandoned; it is a decision made to spare the patient a meaningless treatment escalation or to ensure death with dignity. We cannot exclude the possibility, however, that the large number of patients with treatment restrictions is a reflection of overtreatment, and that too many patients with a previously recorded do-not-resuscitate order were accepted for advanced treatment in medical intermediate care.

We have little knowledge about mortality in medical intermediate care units in Norway, since this is a relatively new innovation and only few units exist. The mortality in Norwegian intensive care units, however, is documented through annual reporting to the Norwegian Intensive Care Registry (6, 12). Some of the reporting units are combined intermediate and intensive care units. Of all patients admitted to intensive care units in 2014 because of an acute medical condition, 19 % died during their hospitalisation (6). In comparison, hospital mortality in our cohort was 13 %.

In Europe, intermediate care units are increasingly being established in departments of internal medicine (13). In an observational study of 167 intensive care units in 17 European countries, the presence on an intermediate care unit in the hospital was associated with significantly lower mortality among patients admitted to the intensive care unit (14), and 25 % of the patients had used the intermediate care unit in connection with their stay in intensive care. Only few studies are available from other countries with comparable intermediate care units in departments of internal medicine that report epidemiological and mortality data. In a Spanish prospective observational study from an intermediate care unit in a department of internal medicine, the mortality rate was 7.8 % in the intermediate care unit and 14.1 % in the hospital (15), which concurs with our figures.

The strength of our study lies in its prospective design. In addition to the use of SAPS-II, comorbidity was rated with Charlson's index, the use of which has been recommended, but so far not published from Norwegian intensive care units (6). The registration is uniform and performed by a small number of persons associated with the unit. One weakness is that

we cannot know whether the admission criteria are applied consistently at all hours of the day, and specialists associated with the unit in the daytime might possibly have rejected admissions that were accepted during the night. Moreover, the population is large and heterogeneous, with considerable variations in terms of diseases and prognoses.

Intermediate care units in departments of internal medicine may meet a need for surveillance and treatment of patients who are too ill for the ward, but who do not need to stay in intensive care. A combination of permanently employed specialists in internal medicine and anaesthesiologists in the unit provides good treatment outcomes.

MAIN MESSAGE

The most common causes for hospitalisation in a medical intermediate care unit were pneumonia, chronic obstructive pulmonary disorder (COPD), sepsis, poisonings and hyponatraemia.

Hospital mortality for patients treated in medical intermediate care units in 2014 was 13 %, with another 14 % dying within one year.

The prognoses for different causes of admission varied greatly – the highest mortality was observed for pneumonia, congestive heart failure, restrictive/neuromuscular respiratory disorder and sepsis.

Patients admitted directly from the emergency department had a better prognosis than patients admitted from a ward.

REFERENCES:

1. Heyerdahl F, Lervåg SO, Skagestad M et al. Hva er en indremedisinsk intensivavdeling? Tidsskr Nor Legeforen 2012; 132: 632 - 3. [PubMed][CrossRef]

2. Flaatten H, Søreide E. Intensivmedisin i Norge. Tidsskr Nor Legeforen 2010; 130: 166 - 8. [PubMed][CrossRef]

3. Knaus WA, Wagner DP, Draper EA et al. The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. Chest 1991; 100: 1619 - 36. [PubMed][CrossRef]

4. Charlson ME, Pompei P, Ales KL et al. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987; 40: 373 - 83. [PubMed][CrossRef]

5. Le Gall JR, Lemeshow S, Saulnier F. A new Simplified Acute Physiology Score (SAPS II) based on a European/North American multicenter study. JAMA 1993; 270: 2957 - 63. [PubMed][CrossRef]

6. Kvåle R. Norsk intensivregisters årsrapport for 2014. https://helse-bergen.no/seksjon/intensivregister/Documents/Årsrapporter%20i%20NIR/NIR%20Årsrapport%202014.pdf (30.1.2018).

7. Kvåle R. Norsk intensivregisters årsrapport for 2012. https://helse-bergen.no/seksjon/intensivregister/Documents/Årsrapporter%20i%20NIR/NIR%20Årsrapport%202012.pdf (30.1.2018).

8. Lillie PJ, Allen J, Hall C et al. Long-term mortality following bloodstream infection. Clin Microbiol Infect 2013; 19: 955 - 60. [PubMed][CrossRef]

9. Goldhill DR, Sumner A. Outcome of intensive care patients in a group of British intensive care units. Crit Care Med 1998; 26: 1337 - 45. [PubMed][CrossRef]

10. Lundberg JS, Perl TM, Wiblin T et al. Septic shock: an analysis of outcomes for patients with onset on hospital wards versus intensive care units. Crit Care Med 1998; 26: 1020 - 4. [PubMed][CrossRef]

11. Simchen E, Sprung CL, Galai N et al. Survival of critically ill patients hospitalized in and out of intensive care. Crit Care Med 2007; 35: 449 - 57. [PubMed][CrossRef]

12. Haagensen R, Smith-Erichsen N. Overvåking av dødelighet i en intensivavdeling. Tidsskr Nor

Laegeforen 2008; 128: 2567 - 9. [PubMed]

13. Vincent JL, Rubenfeld GD. Does intermediate care improve patient outcomes or reduce costs? Crit Care 2015; 19: 89. [PubMed][CrossRef]

14. Working Group on Health Economics of the European Society of Intensive Care Medicine. Hospital mortality of adults admitted to Intensive Care Units in hospitals with and without Intermediate Care Units: a multicentre European cohort study. Crit Care 2014; 18: 551. [PubMed][CrossRef]

15. Torres OH, Francia E, Longobardi V et al. Short- and long-term outcomes of older patients in intermediate care units. Intensive Care Med 2006; 32: 1052 - 9. [PubMed][CrossRef]