DEPARTMENT AUDIT OF INPATIENT MANAGEMENT OF ASTHMA

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ABSTRACT

Rising asthma morbidity and mortality worldwide has prompted the recommendation of guidelines for its management. There has also been recent interest in the role of medical audit in assessing the effectiveness of guidelines, and in identifying deficiencies in clinical practice. We disseminated guidelines for the inpatient management of asthma to our department in March 1994, and subsequently performed a criterion-based audit in which we measured our performance in fulfilling various criteria deemed essential for good asthma management. Three periods in time were audited: a five-week period in March/April 1993 before the existence of guidelines (n=22), the same period in March / April 1994 (n=27), and the month of August 1994 (n=17). The introduction of guidelines resulted in definite improvement in history-taking, physical examination, management, review, monitoring and patient fulfilment of pre-discharge criteria. Specific deficiencies identified were underuse of peak flow measurements, which improved after guidelines; and underprescription of oxygen, which persisted despite the guidelines. No difference was noted in terms of the quality outcome indicators of length of hospital stay, complications of procedures, hospital incidents, morbidity, mortality or visits to the A & E. There was, however, an encouraging drop (although not statistically significant) in the one-month readmission rate from 13.6% in 1993, to 7.4% and 5.9% in 1994, after the introduction of guidelines.

Keywords: *inpatient asthma management, guidelines, medical audit, peak flow monitoring*

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INTRODUCTION

Morbidity and mortality from asthma is rising worldwide despite significant progress in the understanding of its pathophysiology, and the availability of effective treatment. In an attempt to curb this disturbing trend, expert committees in the USA[1], UK[2] and Australia[3] have separately recommended guidelines for the management of acute and chronic asthma. It has been the experience of some and the hope of others that auditing adherence to guidelines will be effective in identifying and correcting areas of deficiencies in clinical practice[4-7], and that this would be reflected in improved patient outcome.

We adapted some of these guidelines for the inpatient management of acute exacerbations of asthma, disseminated the information to our doctors and subsequently audited our department's performance. We sought to evaluate the standard of practice in our department, to identify and improve in areas which were lacking, and to determine if the implementation of guidelines and its adherence resulted in better outcome for our patients. Our audit was criterion-based, in which we defined and agreed on the standard of management which we felt could realistically be achieved, and then measured the performance of our doctors against this standard.

We also audited in terms of various quality indicators such as length of hospital stay, morbidity, mortality and recurrence of exacerbations of asthma requiring visits to the Accident and Emergency (A & E) or hospital admission within one month of discharge.

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METHOD

The audit was carried out on male and female patients aged 12 to 60 years who were admitted to our department for acute exacerbations of asthma. Guidelines were disseminated to our doctors in March 1994, after which the audit was carried out over a five-week period from the last week of March to the end of April 1994. As a means of comparison, we audited our department's performance over the same period in 1993 at which time, no guidelines were in existence. We also repeated the audit in August 1994 after a changeover of medical junior staff had taken place and after these doctors were made aware of the results of the March/April 1994 audit.

We divided our audit into seven sections, namely history-taking, physical examination, investigations, management, review, monitoring and patient fulfilment of certain criteria prior to discharge. Within each section, we identified specific points deemed essential for good asthma management, and our audit was carried out based on whether these points were fulfilled.

History-taking

The five points to be noted in history-taking were the patient's occupation, precipitating factors of asthmatic attacks, previous history of hospital admissions, particularly whether requiring intensive care or intubation, whether the patient smoked, and a family history of asthma.

Physical examination

The five points to be noted in physical examination were the presence of signs of respiratory distress (eg, inability to speak in complete sentences, use of accessory muscles of respiration), pulse rate, respiratory rate, blood pressure and peak flow rate (PEFR).

Investigations

Arterial blood gases and chest X-ray were required if the patient had a history of intubation or admission to intensive care, or if signs of a severe attack were present, as defined by the presence of any one of the following: inability to speak complete sentences,

respiration > 25/min, pulse > 110/min, PEFR < 50% predicted (or best), or absolute PEFR < 120 L/min.

Management

Management entailed prescription of oxygen (2-3 L/min or more), nebulised salbutamol 5-10 mg via oxygen-driven nebulizer (repeated every 15-30 minutes if necessary), addition of nebulised ipratropium bromide 0.5 mg to salbutamol if there was no improvement after 2 doses of salbutamol given 15-30 minutes apart, and prednisolone 30 mg stat and daily, with or without intravenous hydrocortisone 100 mg stat and 6 hourly (at the physician's discretion).

Review

All the patients were expected to be reviewed by the medical officer within one hour of admission, and by the registrar within one hour if features of severe asthma (as defined above) were present, or if there was a history of intubation or admission to intensive care. The patients were to be reviewed again by the medical officer within 4 hours of first being seen, and all admissions before 12 midnight were to have been reviewed by the registrar. The patient was to be transferred to intensive care if, at any time, the following life-threatening features were present: a silent chest, cyanosis or feeble respiratory effort, bradycardia, hypotension, exhaustion, confusion or coma.

Monitoring

The PEFR was to be repeated 15-30 minutes after starting treatment to determine response to treatment. Hourly pulse and respiration were to be monitored if features of severe asthma (as defined above) were present, or if there was a history of previous intubation or admission to intensive care. Arterial blood gases were to be repeated within 2 hours if the initial $PaO_2 < 60$mmHg, or $PaCO_2 > 40$ mmHg, or if the patient clinically deteriorated. The PEFR was to be charted at least twice daily.

Fulfilment of criteria prior to discharge

The PEFR was to have reached at least 70% of the patient's predicted (or best) value and the PEFR diurnal variation [PEFR (pm) - PEFR (am) / PEFR (pm) x 100] <25%. The patient was to have been on the discharge medication for at least 24 hours, and this was to include adequate doses of oral and inhaled steroids (ie prednisolone at least 20 mg daily for 2 weeks, and beclomethasone dipropionate or budesonide at least 800 mcg/day) and an inhaled bronchodilator as needed. A satisfactory inhaler technique was to have been achieved, failing which a spacer obtained for the patient.

Quality indicators

The patient outcome audited were length of hospital stay, complications of procedures, hospital incidents, morbidity, mortality and visits to the A & E or readmission within one month of discharge. Information regarding visits to the A & E and hospital readmissions were obtained from the hospital computer system.

RESULTS

Twenty-two patients were audited in March/April 1993, 27 patients in the same period for 1994, and 17 patients in August 1994. Their mean age, male to female ratio, and mean duration of stay are shown in Table I.

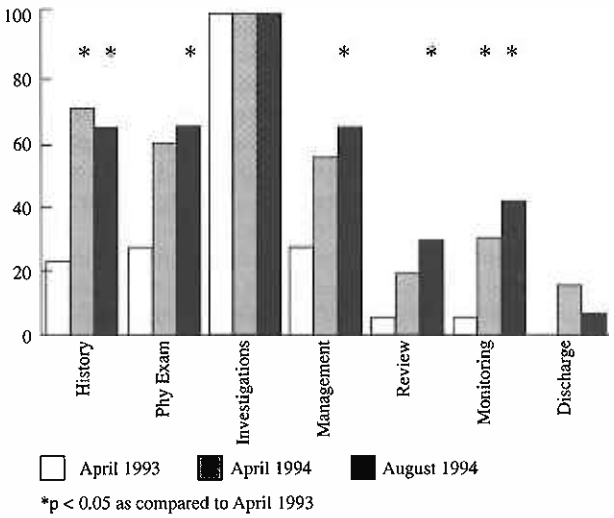
Fig 1 shows the percentage of patients in whom all the criteria were met with regard to the various sections, comparing the three periods audited. Before the implementation of guidelines, our standard of practice (apart from our ability to order investigations) fell sadly far below what we ourselves deemed acceptable. During

Table I – Patient demographics and quality outcome indicators

Period of audit	March/April 1993 n = 22	March/April 1994 n = 27	August 1994 n = 17
Mean age	41.3 years	32.5 years	36.1 years
Male: Female	10: 12	18:9	7:10
Mean duration of stay	4.1 days	3.5 days	3.8 days
Re-admission to hospital within one month	3/22 (13.6%)	2/27 (7.4%)	1/17 (5.9%)
A & E visits within one month	4/22 (18.2%)	6/27 (22.2%)	3/17 (17.6%)
Transfer to MICU	1	0	1
Complications of procedures/ hospital incidents	0	0	0
Morbidity	1 (nosocomial pneumonia)	0	0
Death	0	0	0

There was no statistically significant difference detected when the outcome indicators were compared between the three periods audited.

Fig 1 – Percentage of patients in whom all criteria were fulfilled



*p < 0.05 as compared to April 1993

the period audited in 1993, the percentage of patients in the various sections in whom all the criteria were met were 23% for history-taking, 27% for physical examination, 100% for investigations, 23% for management, 5% for review, 5% for monitoring and zero for fulfilment of pre-discharge criteria. After dissemination of guidelines, our audit of admissions for the March/April 1994 period showed definite improvement in all sections. The percentage of patients in whom all the criteria were met was 70% for history-taking, 59% for physical examination, 100% for investigations, 55% for management, 19% for review, 30% for monitoring and 15% for fulfilment of pre-discharge criteria. The repeat audit in August 1994 showed fairly similar results for history-taking (65%), physical examination (65%), investigations (100%) and management (65%), but with a gratifying improvement in the review and monitoring sections, from 19% to 31% and 30% to 44% respectively. It was, however, disappointing that only 6% of the patients fulfilled all the criteria prior to discharge during this reaudit.

Each criterion in the various sections was also audited

separately (full data not shown). The striking deficiencies noted were the inadequate use of PEFR measurements (failure to measure PEFR on admission, failure to repeat its measurement after institution of treatment and to chart PEFR at least twice daily), and the underprescription of oxygen. PEFR measurements and charting improved markedly after implementation of guidelines in April 1994, but deteriorated slightly in August 1994 (Fig 2). More disturbing is the gross underprescription of oxygen both before and after the introduction of guidelines – only 60% of patients were prescribed oxygen for all the three periods. There was, however, an improvement in the vigilance of our doctors in reviewing the patients over the three periods, as shown by the rising score for the first 4 criteria in the review section (Fig 3).

In terms of treatment, the use of corticosteroids early in admission, and the prescription of adequate doses (inhaled and oral) on discharge were consistently adhered to. In April 1993, 77% of patients were prescribed corticosteroids on admission, as compared to 96% in April 1994, and 83% in August 1994. One hundred per cent of patients in April 1993 were prescribed adequate corticosteroids on discharge, versus 93% in April 1994, and 94% in August 1994.

The main criterion which was not fulfilled prior to discharge

Fig 2 – Percentage of patients in whom PEFR was measured

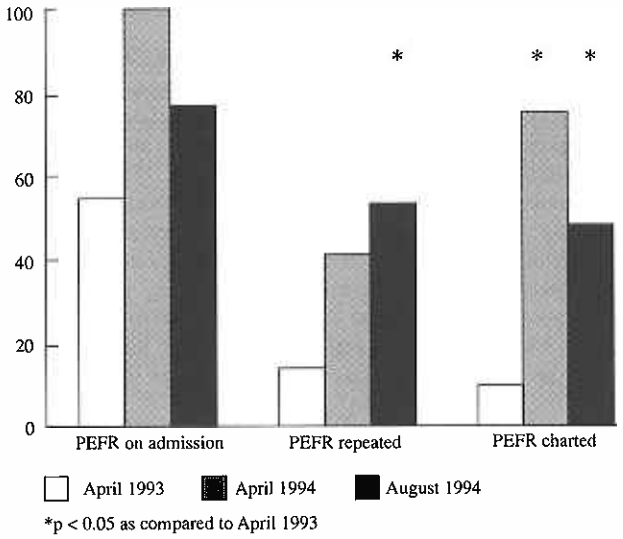
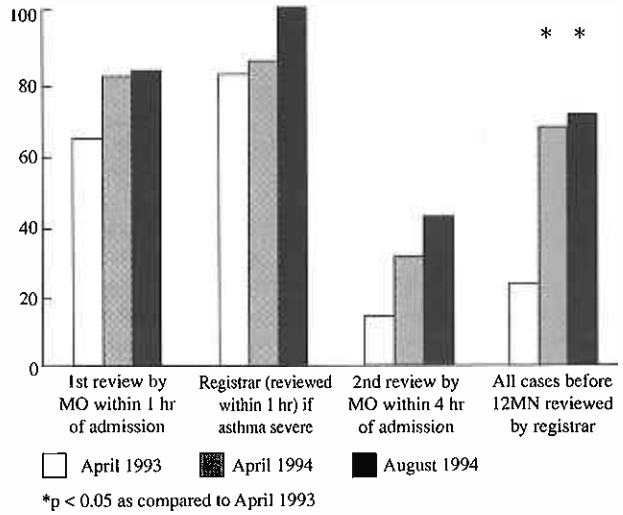


Fig 3 – Percentage of patients in whom criteria for monitoring were fulfilled



was the diurnal variation exceeding 25% at the time of discharge. The two reasons for this were the fact that the PEFR was not charted at least twice daily (hence diurnal variation could not be calculated), and that most of the patients actually felt well, and were keen to be discharged even before their PEFR diurnal variation reached below 25%. There was an improvement in our teaching and checking of inhaler technique prior to discharge (59% were taught in 1993, versus 85% and 77% in April 1994 and August 1994 respectively).

Table I shows the various quality indicators which were audited for the three periods. In April 1993, one patient was transferred to the medical intensive care unit (MICU) for mechanical ventilation, and this patient developed nosocomial pneumonia as a complication of ventilator therapy. During August 1994, one patient was transferred to the MICU for monitoring, who, fortunately, did not require intubation, while another was admitted directly to the MICU after he was intubated at the Accident & Emergency (A & E) Department. There were no complications of procedures, hospital incidents or deaths from asthma during the three periods audited.

For the period audited in 1993, 4 out of 22 patients returned to the A & E within one month of discharge, of whom 3 required re-admission, giving a readmission rate of 13.6%. For the same period in 1994, 6 out of 27 patients returned to the A & E within one month of discharge, and of these, 2 were re-admitted (readmission rate of 7.4%). For the August 1994 period, 3 out of 17 patients returned to the A & E within one month of discharge, with one requiring re-admission (readmission rate of 5.9%).

STATISTICAL ANALYSIS

Statistical analysis was done using the chi-squared test or the Fisher's test depending on the number of subjects analysed.

We assessed the two periods April 1994 and August 1995 to see if there were improvements in meeting criteria for different aspects (Fig 1). Comparing between April 1994 and April 1993, there were statistically significant differences only in the categories of history-taking and monitoring ($p<0.05$). However, between August 1994 and April 1993, there were statistically significant differences in the categories of history-taking, physical examination, management, review and monitoring ($p<0.05$).

We next looked at improvement in the percentage of patients for whom PEFR was measured at admission, repeated and charted. For April 1994, repeat PEFR was more often done than in April 1993. For August 1994, both repeat PEFR and PEFR charting were more often done (Fig 2).

The next aspect we studied was improvements in timely review by medical officers and registrars. There was improvement only in the review of admissions before 12 midnight by the registrar on-call. The improvements shown in the review of patients within one hour of admission by the medical officer, the review of severe asthmatics within one hour by the registrar and the second review within 4 hours by the medical officer did not reach statistical significance (Fig 3).

When the outcome indicators were analysed, there was no statistically significant difference in the duration of stay, readmission rate and A & E visit rate within one month of discharge between the periods April 1994, August 1994 and April 1993 using the chi-squared test.

DISCUSSION

Although our study shows a definite improvement in the overall standard of practice among our doctors after the introduction of guidelines, there is room for further improvement. The criteria set for history-taking, physical examination, management and monitoring are, we feel, the minimum requirements expected for proper asthma management, and it is therefore not

unreasonable to aim for 100% of patients to have all the criteria fulfilled in these sections. Specific areas which need to be improved are the use of PEFR monitoring and charting, and the prescription of oxygen.

It may be unrealistic to expect a 100% score in the review section (perhaps our criteria are too stringent?), bearing in mind the heavy workload of the doctors, especially after office-hours. It may also not be necessary to wait for the patients' PEFR diurnal variation to fall to under 25% before allowing discharge, provided they are prescribed adequate doses of inhaled and oral corticosteroids, are able to use their inhalers correctly, are reasonably confident themselves that they are ready to go home, and are given an early appointment (eg, within 2 weeks) for review at the specialist chest clinic.

Fortunately, there were no asthma deaths during the three periods audited, and only one episode of patient morbidity in the form of ventilator-associated nosocomial pneumonia. This episode occurred before the guidelines were introduced. The decrease in readmissions within one month of discharge after the institution of guidelines (Table I), although not statistically significant, is noteworthy. The low readmission rate after August 1994 was all the more encouraging considering that, during the months of September and October 1994, the air quality in Singapore was in the 'unhealthy range' (as measured by the pollution standard index), owing to forest fires in one of our neighbouring countries.

We would like to have seen a further improvement in our adherence to guidelines with subsequent audit, but this was not borne out by the results of our repeat audit for August 1994. Although there was an overall improvement in physical examination, management, review and monitoring of patients, there was still in inexcusable underuse of PEFR measurement and charting (Fig 2), and underprescription of oxygen, as highlighted above. Interestingly, underuse of PEFR monitoring and oxygen therapy was also reported by Lipworth et al[4] in their audit of acute asthma admissions to a respiratory unit in the UK.

Having identified the areas of deficiency in our inpatient management of acute asthma, it is hoped that, with continued education of our doctors and reinforcement (and modification) of our guidelines, future audit will reveal improvement in our standard of practice, with a corresponding salutary effect on patient outcome.

References

1. National Heart, Lung, and Blood Institute, National Institutes of Health. International Consensus Report on Diagnosis and Management of Asthma. NIH pub no 92-3091, Bethesda, MD: U.S. Department of Health and Human Services, 1992.
2. British Thoracic Society and others. Guidelines for the management of asthma: a summary. Br Med J 1993; 306: 776-82.
3. Woolcock A, Rubinfeld AR, Seale JP, Landau LL, Antic R, Mitchell C, et al. Thoracic Society of Australia and New Zealand. Asthma management plan, 1989. Med J Aust 1989: 15; 650-3.
4. Lipworth BJ, Jackson CM, Ziyaie D, Winter JH, Dhillon PD, Clark RA. An audit of acute asthma admissions to a respiratory unit. Health Bull 1992: 50: 389-98.
5. Lim KL, Harrison BD. A criterion based audit of inpatient asthma care. Closing the feedback loop. J R Coll Physicians Lond 1992; 26: 71-5.
6. Harrison BD, Pearson MG. Audit in adult severe asthma - who benefits? [Review]. J R Coll Physicians Lond 1993; 27: 387-90.
7. Hardy CC, Donovan H, Bell C. Improved asthma care following medical audit. Am J Respir Crit Care Med 1994; 149(4): A1076.