

## Factors associated with inappropriate inpatient prescribing of acid-suppressive therapy

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### Abstract

**Objectives** Acid-suppressive therapy is used for 54–70% of inpatients, and is frequently prescribed for inappropriate indications. The objective of this study was to identify characteristics associated with inappropriate prescribing of acid-suppressive therapy.

**Methods** A random sample of adult internal medicine inpatients admitted between 1 July 2005 and 30 June 2006 was screened for acid-suppressive therapy. Patients receiving such therapy without an accepted indication and those not prescribed acid-suppressive therapy were included in group 1 and group 2, respectively. Significant characteristics from separate univariate regression models were entered into a multivariate logistic regression to determine characteristics associated with inappropriate use. The setting was internal medicine units at a tertiary care academic medical centre.

**Key findings** There were 108 patients in group 1 and 134 patients in group 2. Group 1 patients were older, had a longer median length of stay, a greater number of comorbidities, a greater median number of medications upon admission, and a higher rate of cirrhosis. Factors associated with use of acid-suppressive therapy without an accepted indication were use of a proton-pump inhibitor (odds ratio, 15.3; 95% confidence interval, 4.1–56.3) or histamine<sub>2</sub> receptor antagonist (14.5; 2.8–74.8) prior to admission, cirrhosis (6.4; 1.02–39.5), use of inpatient anticoagulants (2.7; 1.4–5.2) and length of stay (1.1; 1.1–1.3).

**Conclusions** The strongest factors associated with use of acid-suppressive therapy without an accepted indication were use of a proton-pump inhibitor or histamine<sub>2</sub> receptor antagonist prior to admission, a diagnosis of cirrhosis and use of inpatient anticoagulants.

**Keywords** acid suppressive therapy; histamine<sub>2</sub> receptor antagonists; medication overuse; proton-pump inhibitors

### Introduction

Recent studies report rates of inpatient acid-suppressive therapy (AST) use of 54–71%, much of which is for inappropriate indications (65–90%).<sup>[1,2]</sup> Despite relative safety and efficacy, AST overuse can lead to polypharmacy, drug interactions, unjustifiable patient expense and wasted health care resources. Whereas overuse is well documented, risk factors for AST overuse are not clearly defined.<sup>[1,2]</sup> The objective of this study was to identify clinical characteristics that are associated with AST without an accepted indication in adult internal medicine inpatients.

### Methods

This was a retrospective study of adult internal medicine inpatients at a tertiary care academic centre. Patients were eligible if they were 18 years old and admitted to an internal medicine service between 1 July 2005 and 30 June 2006. Patients in an intensive care unit, transferred from an outside hospital or with incomplete medical records were excluded. A randomized, computerized sampling selected equal numbers of weeks per quarter over the study period, and eligible patients admitted during those weeks were chosen for chart review. De-identified admission and discharge summaries and International Classification of Diseases-9th Revision-Clinical Modification (ICD-9-CM) diagnosis codes were screened by the primary

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investigator for therapeutic indications, and patients with accepted indications for AST were excluded. Accepted indications were those supported by US Food and Drug Administration labelling or evidence-based literature and included gastroesophageal reflux disease, dyspepsia, peptic ulcer disease, non-cardiac chest pain, gastric, peptic or duodenal ulcer, Barrett's oesophagus, oesophagitis, gastritis, non-variceal upper gastrointestinal bleed, gastrinoma and hypersecretory disorders.<sup>[3–7]</sup> Dose or duration of therapy was not used to determine appropriateness of prescribing. The remaining patients were divided into group 1 (AST without an accepted indication) and group 2 (no AST therapy). Additional clinical data, including admission and discharge orders, were retrieved from the patients' medical records. The University of Pittsburgh Institutional Review Board approved this study as exempt from informed consent.

Nominal data were compared using the Chi-square test, continuous parametric data were compared using Student's *t*-test or Fisher's exact test, and non-parametric data were compared using the Wilcoxon rank sum test. Significant variables ( $P < 0.10$ ) from separate univariate analyses were entered into a multivariate model. Significant variables ( $P < 0.05$ ) from the multivariate logistic regression were considered predictors of AST without an accepted indication. Statistical analyses were conducted using SPSS version 15.0 software (SPSS, Chicago, IL, USA).

## Results

The analysis included 242 patients (group 1 = 108, group 2 = 134). Group 1 was older (mean age 57 compared with 52 years;  $P = 0.03$ ), had a longer length of stay (median 4 compared with 3 days;  $P < 0.001$ ) and a greater number of comorbidities (median 8 compared with 7;  $P = 0.001$ ). Both groups had similar rates of comorbidities except for cirrhosis (group 1 = 9.3% compared with group 2 = 1.5%;  $P = 0.007$ ). The most common comorbidities in the collective population were hypertension (47%), diabetes (21%) and heart failure (17%). Table 1 displays predictors for inappropriate AST use, which include use of proton-pump inhibitor prior to admission, use of histamine<sub>2</sub> receptor antagonist prior to admission, length of stay, use of inpatient anticoagulants and cirrhosis.

Sixty-five patients (60%) in group 1 had AST initiated in the hospital without a documented indication, and of these patients 14 (22%) were inappropriately discharged on AST as per discharge summary orders. Group 2 did not show an increase in AST use from admission to discharge. Table 2 shows medication use by study group.

## Discussion

Our results demonstrate that receiving AST prior to admission has the strongest association with receiving inpatient AST

**Table 1** Multivariate logistic regression: predictors for inappropriate acid-suppressive therapy use

Variable	$\beta$	SE	OR	95% CI	P value
Age	-0.001	0.010	0.99	0.98–1.02	0.92
Number of comorbidities	-0.03	0.053	0.97	0.88–1.08	0.97
Number of medications PTA	-0.03	0.050	0.97	0.88–1.07	0.51
Length of stay	0.13	0.049	1.14	1.03–1.25	0.009
Proton-pump inhibitor PTA	2.73	0.666	15.3	4.14–56.3	<0.001
Histamine <sub>2</sub> receptor antagonist PTA	2.67	0.839	14.5	2.80–74.8	0.001
Gastroirritant PTA	0.20	0.371	1.22	0.59–2.53	0.59
Inpatient gastroirritant	0.09	0.356	1.10	0.55–2.21	0.79
Inpatient anticoagulant	0.98	0.343	2.67	1.36–5.22	0.004
Cerebrovascular disease	0.71	0.804	2.04	0.42–9.86	0.38
Cirrhosis	1.85	0.933	6.35	1.02–39.5	0.047
Discharge to skilled nursing facility	0.67	0.572	1.96	0.64–6.00	0.24

95% CI, 95% confidence interval; OR, odds ratio; PTA, prior to admission; SE, standard error.

**Table 2** Medication use by study group

Characteristic	Group 1, inappropriate AST (%), <i>n</i> = 108	Group 2, no AST (%), <i>n</i> = 134	P value
Median number of medications prior to admission	6	4	0.001
<i>Medications prior to admission</i>			
Proton-pump inhibitor	27 (25.0)	3 (2.2)	<0.001
Histamine <sub>2</sub> receptor antagonist	16 (14.8)	2 (1.5)	<0.001
Gastroirritant	50 (46.3)	43 (32.1)	0.03
Anticoagulant	19 (17.6)	14 (10.4)	0.13
Antiplatelet	6 (5.6)	3 (2.2)	0.19
<i>Inpatient medications prescribed</i>			
Gastroirritant	76 (70.4)	79 (59.0)	0.08
Anticoagulant	63 (58.3)	44 (32.8)	<0.001
Antiplatelet	7 (6.5)	5 (3.7)	0.38

AST, acid-suppressive therapy.

without an accepted indication. These findings are consistent with other studies investigating overuse.<sup>[1]</sup> AST may have been continued without validation or documentation of the therapeutic indication.

This study was limited by the retrospective design, restricting investigators to previously documented records. Limited access to outpatient records made it difficult to determine duration of treatment, and therefore the investigators could use only the indication to assign appropriateness. Additionally, determining appropriateness of stress ulcer prophylaxis was challenging, and intensive care unit patients were excluded due to the inability to ascertain all relevant risk factors such as time on mechanical ventilation. It is possible that patients with accepted indications may have been included in group 1 due to incomplete documentation.

In this study, 60% of AST was initiated in the hospital without documentation of a new indication, consistent with rates reported previously (65%).<sup>[1]</sup> We did not collect reasons for AST use, but observed that AST was ordered frequently as prophylaxis. Heidelbaugh and Inadomi<sup>[8]</sup> found that stress ulcer prophylaxis was overused on internal medicine services and that evidence-based criteria for AST use was lacking in those patients who have few, if any factors indicating prophylaxis.<sup>[8,9]</sup> Additionally, prescribers may view patients with certain disease states as physiologically stressed and order prophylaxis, as patients with cirrhosis were more likely to receive AST in this study.<sup>[9]</sup>

Concomitant anticoagulant medications were associated with AST overuse, and this may indicate that prescribers are attempting to minimize gastrointestinal bleeding. There are no guidelines to support the concomitant use of AST and anticoagulants to decrease the risk of gastrointestinal bleeding.<sup>[10]</sup> Guidelines recommend prophylaxis for patients who are coagulopathic, but this does not generally apply to patients who are taking agents expected to increase prothrombin time and activated partial thromboplastin time.<sup>[9]</sup>

Increasing awareness and targeting patients who have these characteristics can help to prevent ongoing overuse of AST. Pharmacists can educate providers about the indications and guidelines. They can participate in care of inpatients by determining the necessity to continue outpatient medications in the inpatient setting and recommending safe and effective therapy in the hospital. Involving a pharmacist in discharge planning ensures safe discontinuation of medications no longer needed for outpatient care and promotes continuity of care as the patient transitions back to his outpatient provider. Additionally, medication reconciliation performed by all health care professionals can help to reduce polypharmacy, adverse effects and expenses that are concerns of all therapy, including AST.

## Conclusions

In summary, characteristics associated with AST use without an accepted indication in this inpatient population include use of proton-pump inhibitor or histamine<sub>2</sub> receptor antagonist prior to admission, cirrhosis, inpatient anticoagulant use and longer length of stay. This study increases awareness of these characteristics, and reveals targets for education and clinical interventions.

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## Conflict of interest

The Author(s) declare(s) that they have no conflicts of interest to disclose.

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