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ORIGINAL ARTICLE

# International multidisciplinary survey on the initial management of acute pancreatitis: Perspective of point-of-care specialists focused on daily practice

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## Abstract

**Background:** The initial management of patients with acute pancreatitis impacts both morbidity and mortality. Point-of-care decisions have been reported to differ from clinical guideline recommendations.

**Methods:** An online anonymous questionnaire was distributed through scientific associations and social media using REDCap. Multivariable logistic regression

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was used to identify the characteristics of participants associated with compliance with the recommendations.

**Results:** A total of 1054 participants from 94 countries completed the questionnaire; median age (IQR) was 39 (32–47) years; 30.7% were women. Among the participants, 37% opted for nonmoderate flow of i.v. fluid, 31% for fluid type other than Ringer's lactate; 73.4% were in favor of nil per os to patients who could eat, 75.5% for other than enteral feeding to patients with oral intolerance; 15.5% used prophylactic antibiotic in patients with severe acute pancreatitis, 34.1% in necrotizing acute pancreatitis, and 27.4% in patients with systemic inflammatory response syndrome; 27.8% delayed cholecystectomy after biliary acute pancreatitis. Participants with publications in PubMed on acute pancreatitis showed better compliance (OR, 1.62; 95% CI: 1.15–2.32; $P = .007$) with recommendations of the clinical guidelines.

**Conclusions:** Feeding and nutrition require the greatest improvement efforts, but also the use of prophylactic antibiotics and timing of cholecystectomy should be improved.

**KEYWORDS**

antibiotic prophylaxis, cholecystectomy timing, feeding and nutrition, fluid therapy, ursodeoxycholic acid

## 1 | INTRODUCTION

According to the Global Burden of Disease Study 2017, the incidence of pancreatitis (acute and chronic) is 20.6 per 100 000 population.[1] In the United States, the annual incidence of acute pancreatitis (AP) ranges from 13 to 45 per 100 000 population.[2] A recent systematic review and meta-analysis showed that the incidence of AP has increased in most geographic regions of the world over the past half century.[3] With nearly 300 000 visits annually, pancreatitis ranks third in discharge diagnoses among digestive and liver diseases in the United States.[4] AP constitutes a challenging health problem due to the lack of specific treatment and the high mortality of severe forms.[5] Initial supportive care and adequate management of subsequent complications are the only tools available to mitigate this deleterious impact of AP.[6]

In the early 2000s, several local studies explored compliance with the recommendations of scientific societies in the management of patients with AP. The compliance discrepancies detected were greater in the practice of nonspecialists in hepatobiliary and pancreatic surgery,[7] and reflected insufficient evidence or evidence based solely on expert opinion, lack of controlled clinical trials,[8] not adequate stratification of severity,[9] or poor adherence to the clinical guidelines available at the time.[10] In the past decade, various international scientific associations have endorsed clinical practice guidelines for the management of patients with AP.[11–15] However, as with many health conditions that involve complex and difficult management strategies, the implementation of expert recommendations in daily health care is often suboptimal.

Routine clinical practice can vary widely as experience and infrastructure play a decisive role. The majority of patients (between 65 and 80%) present a mild form and recover completely within a few days.[5,16] Yet, compliance with fluid therapy, oral diet, antibiotic therapy, and management of frequently-associated cholelithiasis are not uniform throughout the world. A recent international survey carried out mainly in Asian countries detected that noncompliance with recommendations on analgesia, hydration, diet and antibiotics existed in the initial phase of AP.[17] Hence the relevance of evaluating the diversity of routine clinical practice and comparing it with the best evidence available.

Little is known about the decision-making process that gastroenterologists, internists, surgeons, or general practitioners/ primary care physicians employ when faced with the management of a complex entity such as AP. The purpose of this international multidisciplinary survey was to take a snapshot of the attitude of experts and nonexperts alike in the initial management of AP. The most recent evidence-based clinical practice guidelines were used as a reference.[11–15] First, the degree of global compliance of all participants with each management item was quantified. Next, multivariate logistic

regression was used to identify the characteristics of participants associated with compliance with each management item, as well as the characteristics of participants associated with compliance with all items as a whole. It was felt that identifying disparities between recommendations and routine point-of-care management could guide valuable strategies for quality improvement in the early phase of AP.

## 2 | METHODS

### 2.1 | Study design

The questionnaire consisted of two parts. The first was aimed at characterizing the professional profile of the participants, the second was designed to characterize the strategies currently used by professionals in the management of patients with AP during the first 72 h after admission. The questions were written by a group of coordinators (NL, JMR, EdM and FL), and then shared with an international multidisciplinary panel of experts in AP. The final set of questions was agreed by the coordinators and the panel of experts.

Clinical practice guidelines on AP published in the last decade have served as a reference in the present study.[11,12,14,15] The most frequently early management issues addressed in the guidelines are related to fluid resuscitation, prophylactic antibiotics, early oral, enteral, or parenteral feeding, and the timing of cholecystectomy. The clinical practice guideline endorsed by the American Gastroenterological Association (AGA) Institute[14] and the World Society of Emergency Surgery[15] summarized and updated the concepts addressed in previous practice guidelines by the International Association of Pancreatology/American Pancreatic Association (IAP/APA)[11] and American College of Gastroenterology (ACG)[12] and were used as reference in the present study.

To verify clarity, flow of content, and adequate length of the questionnaire, a pilot test was carried out with 19 specialists. Participants were urged to provide responses that reflected as closely as possible their current daily clinical practice. This was an anonymous survey, even for the study coordinators. The final version of the questionnaire on Initial Management of AP (the IMAP Survey) is included in Appendix S1.

Study data were collected and managed using REDCap electronic data capture tools hosted at Asociación Española de Gastroenterología (AEG; www.redcap.aegastro.es). AEG is a nonprofit Scientific and Medical Society focused on Gastroenterology, and it provided this service free of charge, with the sole aim of promoting independent investigator driven research. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies.[18]

### 2.2 | Survey distribution

Potentially interested scientific societies were contacted, a short executive summary and a link to the survey was provided to be posted on the society's website and/or be sent as a newsletter to the society members to invite them to participate. The survey was finally distributed through the European Pancreatic Club (homepage, mailing, newsletter), Swedish Biliary-Pancreatic Club (newsletter), Australian New Zealand Alliance for Pancreas Research (mailing), United European Gastroenterology (mailing), Italian Society of Gastroenterology (newsletter), and Canadian Association of General Surgeons (newsletter). In parallel, the summary and the link were disseminated via social media (Twitter, Facebook, LinkedIn). The questionnaire was accessible on REDCap with the link provided through scientific societies and social media; no registration or password required. The study coordinators did not have access to the email addresses or the identity of the participants. A sample size exceeding 1000 completed questionnaires was predefined to allow for consistent analysis and meaningful conclusions with sufficient granularity and level of detail to provide answers to the questions, and the survey was closed upon reaching this goal.

### 2.3 | Analysis

Descriptive statistics was used for demographic and professional characteristics of participants. Quantitative variables are reported as median and interquartile range (IQR), and categorical variables as absolute and relative frequencies. Differences between groups of participants were compared using the Chi-square test or Fisher's exact test for categorical data, the *t*-test for parametric quantitative data, and the Mann–Whitney U test for quantitative nonparametric data. Univariable and multivariable logistic regression was used to determine whether there was an association between demographic and professional characteristics of participants and their answers to questions related to fluid therapy, use of prophylactic antibiotics, nutrition, and cholecystectomy. Specific responses were selected in accordance with the recommendations provided in the clinical guidelines. The characteristics corresponding to the highest proportion of participants in each domain (i.e., Europe, among geographic regions) were selected as a reference. Participant characteristics obtained in response to subsidiary or branching questions (i.e., specific social media platforms) or to questions with multiple possible answers (i.e., pain management, criteria for Intensive Care Unit [ICU]

admission) were excluded from the logistic regression analysis since they do not apply to all participants or are iterative. In addition, multivariable logistic regression was used to identify the characteristics of participants associated with compliance with all items as a whole. *P*-values of less than .05 were considered statistically significant. All analyses were carried out using RStudio, version 1.2.5001 (Integrated Development for R. RStudio, Inc.). Planning and analysis of the study was carried out according to the AAPOR Reporting Guidelines for Survey Studies.[19]

## 3 | RESULTS

### 3.1 | Participants

The survey was distributed online between May and August 2021. The participants accessed the questionnaire through a scientific association (32.4%) or social media (54.6%); Twitter was the most used social media platform (Table 1). In total, 1625 participants responded to the survey (Figure S1). Finally, the responses of 1054 participants from 94 countries who completed the questionnaire were analyzed. Correct answers to each question according to clinical guidelines are indicated by an asterisk in Table 2. Although there was a possibility that the same participant or general people would submit multiple questionnaires, it was not in our ability to confirm or prevent this practice. However, further analysis showed that there were no differences between responses to all clinical management-specific items between participants who accessed the survey through scientific associations and those who accessed the survey through social media (see Tables S5–S13, Survey accessibility). A heat map (Figure 1) and a list of countries (Table S1) are shown with the number of participants from each country. By region, Europe contributed the largest share of participants, followed by Central/South-America, Asia/Oceania, North-America and Africa (Table 1). More men (68.7%) than women (30.7%) participated in the survey. The median (IQR) age of participants was 39 (32–47) years. The majority of participants described themselves as fully trained (75.5%) and about half of these had more than 10 years of experience (Table 1).

### 3.2 | Involvement of participants in patient care and engagement to research

Almost half of the survey participants (44%) have cared for AP patients for more than 10 years (Table 1). Most participants (86.6%) have personally cared for patients with AP and managed between 50 and 100 of these patients per year (Table 1). Over the past 10 years, one fifth of survey

**TABLE 1** Demographic and professional characteristics of 1054 participants

| Characteristics | Branched responses n (%) | Participants n (%) |
|---|---|---|
| Global location | | |
| Geographic region | | |
| Africa | | 58 (5.5) |
| Asia/Oceania | | 187 (17.7) |
| Central/South America | | 269 (25.5) |
| Europe | | 420 (39.8) |
| North America | | 120 (11.4) |
| Demographic | | |
| Gender | | |
| Woman | | 324 (30.7) |
| Man | | 724 (68.7) |
| Nonbinary/Other | | 6 (0.6) |
| Age, years, median (IQR) | | 39 (32–47) |
| Career | | |
| Current practice | | |
| Residency program | | 191 (18.1) |
| Fellowship program | | 67 (6.4) |
| Fully trained | | 796 (75.5) |
| <5 years | 239 (30.0) | |
| 5–10 years | 191 (24.0) | |
| >10 years | 363 (45.6) | |
| NA | 3 (0.4) | |
| Survey accessibility | | |
| Source through which you accessed the link to the survey | | |
| Scientific association | | 341 (32.4) |
| Social media | | 576 (54.6) |
| Twitter | 382 (66.3) | |
| Facebook | 87 (15.1) | |
| LinkedIn | 25 (4.3) | |
| Other | 81 (14.1) | |
| NA | 1 (0.2) | |
| Other | | 137 (13.0) |
| Personal involvement in patient care and commitment to research | | |
| Years that you have been caring for patients with AP | | |
| <5 years | | 270 (25.6) |
| 5–10 years | | 320 (30.4) |
| >10 years | | 464 (44.0) |
| Currently, you personally manage patients with AP | | |
| No | | 141 (13.4) |
| Yes | | 913 (86.6) |

**TABLE 1** (Continued)

| Characteristics | Branched responses n (%) | Participants n (%) |
|---|---|---|
| <10 patients/year | 172 (18.8) | |
| 10–50 patients/year | 560 (61.3) | |
| >50 patients/year | 180 (19.7) | |
| NA | 1 (0.1) | |
| Publications in PubMed on acute pancreatitis over last 10 years | | |
| None | | 829 (78.7) |
| Yes | | 225 (21.3) |
| Number of articles, n, median (IQR) | 3 (2–10) | |
| Professional profile | | |
| Your specialty | | |
| Gastroenterology and Hepatology | | 541 (51.3) |
| Surgery | | 382 (36.2) |
| Internal medicine | | 35 (3.3) |
| Emergency care | | 16 (1.5) |
| Advanced digestive Endoscopy | | 44 (4.2) |
| Intensive care | | 15 (1.4) |
| Family medicine/general Practitioner/primary care/other | | 21 (2.0) |

Abbreviations: AP, acute pancreatitis; NA, not available.

participants (21.3%) have published a median (IQR) of 3 (2–10) AP-related articles cited in PubMed. Half of the participants were specialists in gastroenterology and hepatology (51.3%), followed by surgery (36.2%) and others (Table 1). Additional results regarding current practice of participants and activity load of specialized units, characteristics of hospitals and engagement in teamwork, prediction of severity, pain management, imaging preferences, and dissolution of gallstones with ursodeoxycholic acid can be found in Appendix S1.

## 3.3 | Fluid type and flow

*Q: Upon admission, your patient has moderate abdominal pain, respiratory rate is 20/min, blood pressure is*

**TABLE 2** Management of cases regarding fluid therapy, antibiotic use, feeding and nutrition, and timing of cholecystectomy

| Management item | Branched responses n (%) | Participants n (%) |
|---|---|---|
| Fluid therapy | | |
| Fluid type | | |
| Ringer's lactate * | | 727 (69.0) |
| Normal saline | | 300 (28.5) |
| Colloids | | 7 (0.7) |
| Other | | 20 (1.9) |
| Fluid rate | | |
| Restrictive (≤1 ml/kg-h) [1680 ml] | | 63 (6.0) |
| Moderate (1.5 ml/kg-h) [2520 ml, approximately]* | | 664 (63.0) |
| Aggressive (3 ml/kg-h) [5040 ml] | | 327 (31.0) |
| Antibiotic | | |
| Severe AP | | |
| No antibiotic administration * | | 891 (84.5) |
| Prophylactic antibiotic | | 163 (15.5) |
| Carbapenem (i.e., imipenem, meropenem) | 54 (33.1) | |
| Quinolone (i.e., ciprofloxacin, ofloxacin) | 24 (14.7) | |
| Cephalosporine (i.e., cefuroxime, ceftazidime) | 45 (27.6) | |
| Penicillin/beta-lactamase inhibitor | 19 (11.7) | |
| Metronidazole | 4 (2.5) | |
| According to the sensitivity strains in my hospital | 16 (9.8) | |
| Other | 0 (0.0) | |
| NA | 1 (0.6) | |
| Necrotizing AP | | |
| No antibiotic administration * | | 695 (65.9) |
| Prophylactic antibiotic | | 359 (34.1) |
| Carbapenem (i.e., imipenem, meropenem) | 182 (50.7) | |

(Continues)

TABLE 2 (Continued)

| Management item | Branched responses n (%) | Participants n (%) |
|---|---|---|
| Quinolone (i.e., ciprofloxacin, ofloxacin) | 21 (5.8) | |
| Cephalosporine (i.e., cefuroxime, ceftazidime) | 61 (17.0) | |
| Penicillin/beta-lactamase inhibitor | 61 (17.0) | |
| Metronidazole | 5 (1.4) | |
| According to the sensitivity strains in my hospital | 27 (7.5) | |
| Other | 1 (0.3) | |
| NA | 1 (0.1) | |
| SIRS AP | | |
| No antibiotic administration * | | 765 (72.6) |
| Prophylactic antibiotic | | 289 (27.4) |
| Carbapenem (i.e., imipenem, meropenem) | 119 (41.2) | |
| Quinolone (i.e., ciprofloxacin, ofloxacin) | 21 (7.3) | |
| Cephalosporine (i.e., cefuroxime, ceftazidime) | 70 (24.2) | |
| Penicillin/beta-lactamase inhibitor | 48 (16.6) | |
| Metronidazole | 5 (1.7) | |
| According to the sensitivity strains in my hospital | 24 (8.3) | |
| Other | 0 (0.0) | |
| NA | 2 (0.7) | |
| Feeding and nutrition | | |
| Not vomited | | |
| Place a non per oral order and allow sips of water | | 467 (44.3) |
| Accept placement of a nasogastric tube | | 107 (10.2) |
| Start an oral diet * | | 280 (26.6) |
| Accept placement of a peripheral venous line and start partial PN | | 76 (7.2) |
| Accept placement of a central venous line and start total PN | | 15 (1.4) |
| Start enteral nutrition through nasogastric or nasojejunal route | | 109 (10.3) |
| Vomited | | |
| Place a non per oral order | | 172 (16.3) |
| Place a non per oral order and allow sips of water | | 99 (9.4) |
| Accept placement of a nasogastric tube | | 346 (32.8) |
| Accept placement of a peripheral venous line and start partial PN | | 116 (11.0) |
| Accept placement of a central venous line and start total PN | | 63 (6.0) |
| Accept placement of a nasogastric tube and start EN * | | 116 (11.0) |
| Accept placement of a double-lumen tube and start EN * | | 142 (13.5) |
| Cholecystectomy | | |
| In a few months | | 249 (23.6) |
| During index admission * | | 761 (72.2) |
| Only if a second episode occurs | | 44 (4.2) |

Abbreviations: AP, acute pancreatitis; EN, enteral nutrition; NA, not available; PN, parenteral nutrition; SIRS, systemic inflammatory response syndrome.

*Appropriate answers to each question according to the clinical guidelines.

*120/80 mmHg, and pulse is 75/min. Laboratory studies reveal hemoglobin 15 g/dl, hematocrit 40%, and normal kidney function.*

*(a) Indicate the fluid type that you will prescribe for initial resuscitation:*

The majority of participants (69%) prescribed Ringer's lactate for initial resuscitation (Table 2). In multivariable analysis, participants from Africa ($P < .001$), women ($P = .03$), those who did not personally manage AP patients ($P = .006$), surgeons ($P < .001$), or those who worked in a hospital that did not receive referrals from other centers ($P = .03$) were more likely to prescribe other fluids

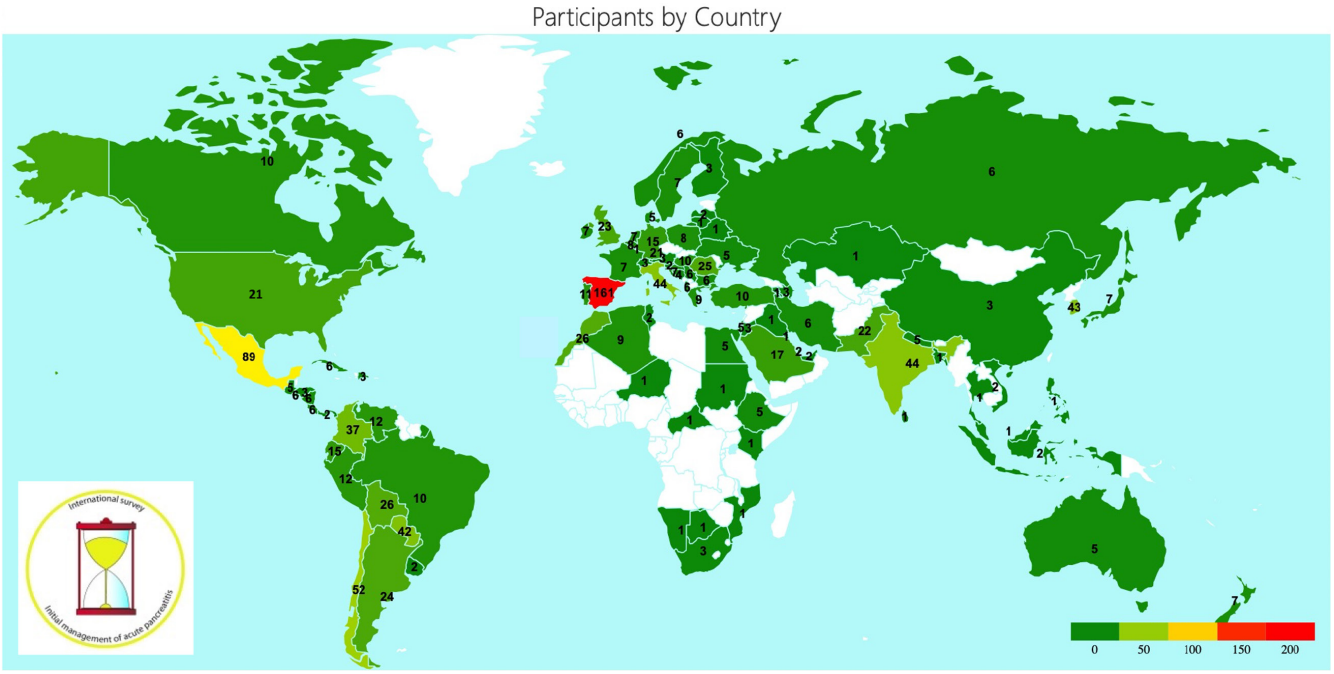


**FIGURE 1** Heat map by country with the number of participants who completed the survey

such as normal saline (28.5%), colloids (0.7%), or other (1,9%) (Figure 2, and Table S5).

*(b) In this same patient, indicate the fluid rate that you will prescribe for initial resuscitation.*

For initial resuscitation, most participants (63%) prescribed a moderate fluid rate (1.5 ml/kg-h [2520 ml/24 h, approximately]) (Table 2). In the multivariable analysis, participants from Central/South America ($P = .02$) and North America ($P = .03$), were more likely to prescribe either a restrictive (≤1 ml/kg-h [1680 ml]) (6%) or an aggressive fluid rate (3 ml/kg-h [5040 ml]) (31%). In contrast, surgeons ($P = .01$) were less likely to prescribe any fluid rate other than moderate (Figure 2, and Table S6).

## 3.4 | Prophylactic antibiotic

*Q: Your patient has predicted severe AP during the initial phase (0–72 h). Select your approach.*

If the risk prediction pointed towards severe AP, a large majority of participants (84.5%) chose not to administer antibiotics (Table 2). However, in the multivariable analysis, participants from Asia/Oceania ($P < .001$), women ($P = .002$), residents in training ($P = .003$), surgeons ($P = .008$), other specialists ($P < .001$), and participants who worked in hospitals that admitted less than 50 patients with AP per year ($P = .003$), or between 50 and 100 patients per year ($P = .02$), were more likely to administer prophylactic antibiotics (Figure 2, and Table S7). The most widely used antibiotics were carbapenems (33.1%) and cephalosporins (27.6%) (Table 2).

*Q: Your patient has necrotizing AP during the initial phase (0–72 h). Select your approach.*

In a patient with necrotizing pancreatitis, two thirds of the participants (65.9%) did not prescribe antibiotics (Table 2). Multivariable analysis indicated that participants from Asia/Oceania ($P = .001$), residents in training ($P = .01$), nonsurgeon specialists ($P < .001$), participants who worked in hospitals who admitted less than 50 patients with AP per year ($P = .002$), and those who always sought ICU evaluation ($P = .03$) were more likely to prescribe antibiotic prophylaxis (Figure 2, and Table S8). More than half (50.7%) prescribed carbapenems (Table 2). In contrast, participants from Africa ($P = .04$) and Central/South America ($P = .003$) were less likely to prescribe antibiotic prophylaxis in a patient with necrotizing pancreatitis (Figure 2, and Table S8).

*Q: Your patient has a low-grade fever (i.e., 37.5°C/99.5°F) and leukocytosis during the initial phase (0–72 h) and no other sources of infection. Select your approach.*

In a patient with systemic inflammatory response syndrome (SIRS), the majority of participants (72.6%) chose not to prescribe an antibiotic (Table 2). However, participants from Asia/Oceania ($P = .004$), those who did not manage patients personally ($P = .006$), surgeons ($P < .001$), other specialists ($P = .001$), participants who worked in a hospital with more than 1000 beds ($P = .01$), or those who worked in a hospital that admitted less than

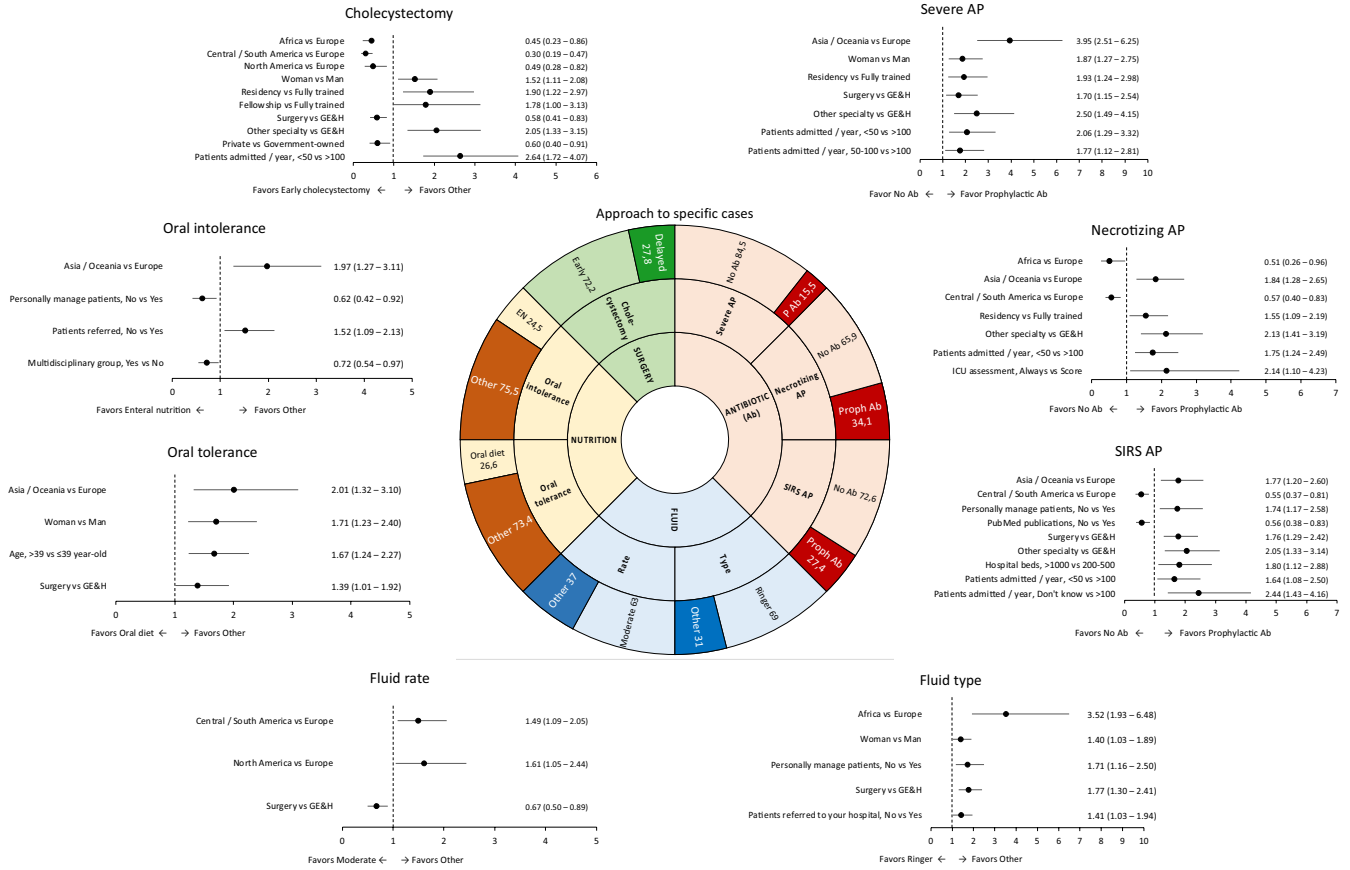


**FIGURE 2** Sunburst chart: Case management. Forest plots: Association between demographic and professional characteristics of participants and their answers to questions raised in clinical cases related to fluid therapy, use of prophylactic antibiotics, nutrition, and cholecystectomy.

50 patients a year with AP ($P = .02$), or who did not know how many patients were admitted ($P = .001$) were more likely to prescribe antibiotic prophylaxis in a patient with SIRS (Figure 2, and Table S9). Carbapenems (41.2%) and cephalosporins (24.2%) were the most prescribed regimens (Table 2). In contrast, participants from Central/South America ($P = .003$) and those without PubMed publications on AP in the last 10 years ($P = .004$) were less likely to administer prophylactic antibiotics (Figure 2, and Table S9).

## 3.5 | When and how to feed

*Q: On the second hospitalization day, your patient complains of epigastric discomfort, has not vomited, has mild abdominal distension and reduced peristaltic movements. Your recommendation for your patient is.*

Faced with a patient who reports no vomiting, 26.6% of participants recommended starting an oral diet (Table 2). Most recommended placing a nil per mouth order and allow sips of water (44.3%), accept placement of a nasogastric tube (10.2%), accept placement of a peripheral venous line and start partial parenteral nutrition (7.2%), accept placement of a central venous line and start total parenteral nutrition (1.4%), or start enteral nutrition through whichever route (nasogastric or nasojejunal) is more readily available (10.3%). In multivariable analysis, Asian/Oceania participants ($P = .001$), women ($P = .002$), participants over 39 years of age ($P < .001$), and surgeons ($P = .046$) were more likely to recommend other than an oral diet (Figure 2, and Table S10).

*Q: On the second hospitalization day, your patient has abdominal distension, reports vomiting and has no appetite. Your initial recommendation to your patient is.*

In the presence of a patient who reports vomiting, 24.5% of participants recommended starting enteral nutrition via nasogastric tube or nasogastrojejunal tube with double lumen (Table 2). Most participants recommended placing a non per oral order (16.3%), placing a non per oral order and allow sips of water (9.4%), accept placement of a nasogastric tube (32.8%), accept placement of a peripheral venous line and start partial parenteral nutrition (11%), or accept placement of a central venous line and start total parenteral nutrition (6%). Participants from Asia/Oceania ($P = .003$) and those

who worked in hospitals that did not receive referrals from other centers ($P = .02$) were more likely to recommend other than enteral nutrition (Figure 2, and Table S11). In contrast, participants who did not manage patients ($P = .02$) and those who belonged to multidisciplinary groups ($P = .03$) were more likely to recommend enteral nutrition (Figure 2, and Table S11). For enteral nutrition, participants preferred semi-elemental (41.5%) over polymeric formulas (25.8%).

## 3.6 | Time for cholecystectomy

*Q: Your patient has a mild episode of biliary AP, is tolerating an oral diet, liver function tests have normalized, and has no past history of biliary colic. Your recommendation is.*

The majority of survey participants (72.2%) recommended performing an early cholecystectomy during index admission or within a few days after discharge (Table 2). A minority recommended delayed cholecystectomy after a few months to allow time for the pancreatic inflammation to resolve (23.6%), or optional cholecystectomy if a second episode of AP occurs (4.2%). Women ($P = .01$), residents in training ($P = .005$) and fellows ($P = .047$), nonsurgeon specialists ($P = .001$), and participants who worked in hospitals that admitted less than 50 patients with AP per year ($P < .001$) were more likely to recommend delayed or optional cholecystectomy (Figure 2, and Table S12). In contrast, participants from Africa ($P = .02$), Central/South-America ($P < .001$) and North-America ($P = .01$), surgeons ($P = .003$) and participants from private centers ($P = .02$) were more likely to recommend early cholecystectomy (Figure 2, and Table S12).

## 3.7 | Compliance with clinical practice guidelines

The degree of compliance was good/excellent (meaning 5 to 8 matching responses) in 62.2% of participants, and poor/moderate (0 to 4 matching responses) in the remaining 37.8% (Figure 3). In multivariable analysis, participants from Asia/Oceania ($P = .01$), surgeons ($P = .046$), other specialists ($P < .001$), and those participants unaware of the number of patients with AP admitted annually ($P = .02$) were more likely to poorly/moderately comply with the recommendations of the clinical practice guidelines (Figure 3, and Table S13). On the other hand, participants with PubMed publications on AP in the last 10 years ($P = .007$) were more likely to achieve good/excellent compliance with evidence-based clinical practice guidelines (Figure 3, and Table S13).

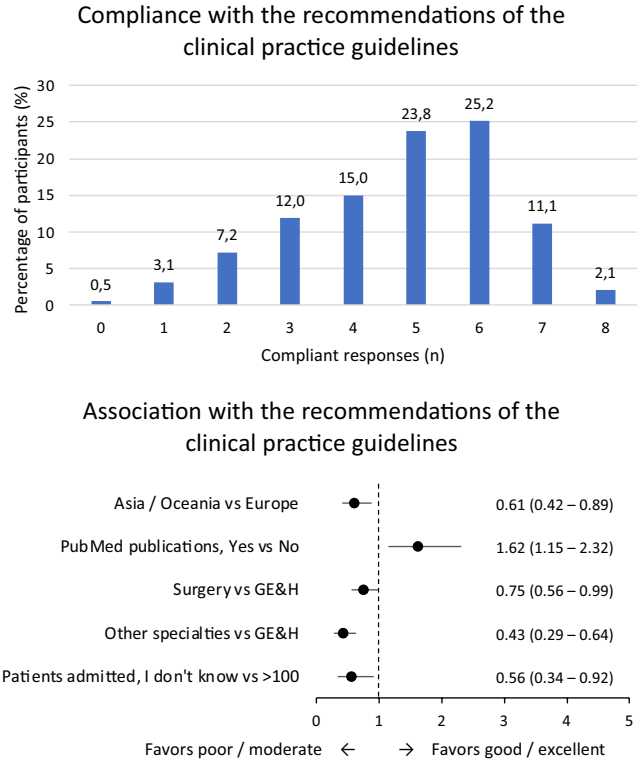


**FIGURE 3** Top panel: Responses of participants in line with the recommendations of the clinical practice guidelines. Bottom panel: Demographic and professional characteristics of participants associated with the recommendations of the clinical practice guidelines; good/ excellent (meaning 5 to 8 compliant responses); poor/ moderate (0 to 4 compliant responses). GE&H: Gastroenterology & Hepatology.

# 4 | DISCUSSION

This largest international survey to date on adherence to guideline recommendations in the treatment of patients with acute pancreatitis gathered over 1000 participants from five continents, with Europe and Central/ South America being the most represented. Participants were positioned at different stages of their professional careers, directly involved or not in the care of patients with AP. They belonged to various medical specialties, worked in specific or general units, and may or may not had publications in PubMed on AP. The survey raised clinical cases of patients with mild or severe acute pancreatitis, but not intermediate clinical presentations of the disease. Therefore, the survey findings are applicable to these binary scenarios. However, the spectrum of severity of acute pancreatitis ranges from mild to severe forms, and it is the responsibility of the medical team in charge to manage each patient individually.

Early fluid resuscitation is addressed in all the clinical practice guidelines. Although the guidelines do not recommend a type of fluid, recent evidence suggests that the use

of Ringer's lactate is associated with improved outcomes.[20] The survey showed that the majority of participants (69%) used Ringer's lactate as the preferred resuscitation fluid in their current daily practice. The nonavailability of Ringer's lactate at the point of care can be decisive. It is, therefore, a resource issue and a potentially solvable factor for improvement. Goal-directed therapy to maintain arterial pulse rate, mean arterial pressure, central venous pressure, urinary output, normal serum urea, and hematocrit is a common suggestion, not a recommendation. Although it is difficult to establish common guidelines for fluid administration due to the diversity of comorbidities present in patients with AP, recent studies suggest that aggressive therapy carries a risk of overload and may potentially be responsible for severe adverse events.[21–23] The majority of participants (63%) prescribed a moderate fluid rate for early resuscitation of patients with AP. North and Central/South American participants were less likely to prescribe a moderate rate, while surgeons were more likely to adhere to a moderate rate.

Evidence-based clinical guidelines agree that prophylactic administration of antibiotics in the initial phase of AP has no beneficial impact on persistent multi-organ dysfunction or failure, neither on the length of hospital stay.[11,12,14,15,24] The results of the survey are in line with an international study that warned about the global overuse of antibiotics in acute pancreatitis and provided recommendations for improvement.[25] In addition, the survey identified several characteristics of the participants more likely to initiate antibiotic prophylaxis in one or more of the described forms of pancreatitis. They were from Asia/Oceania, women, residents in training, surgeons, other nonsurgical specialists, those who work in hospitals that admit less than 100 patients with AP per year, or in hospitals with more than 1000 beds. In contrast, the survey revealed that participants from Africa, Central/South America, and those who publish articles related to AP cited in PubMed were less likely to prescribe antibiotic prophylaxis. These data can help direct outreach campaigns to prevent the misuse of antibiotics in the early phase of AP.

More than half of the survey participants placed a nil by mouth order (44.3%) or a nasogastric tube (10.2%) to a patient who does not vomit. A minority of participants prescribed peripheral (11%) or total (1.4%) parenteral feeding, or even enteral feeding (10.3%). However, only a quarter of the participants (26.6%) chose to start an oral diet, which coincides with the recommendations of the clinical practice guidelines.[11,12,14] Similarly, in a nutrition-focused survey of 178 pancreatologists, mostly from Europe and North America, 26.7% prescribed oral nutrition on the first day, and 59.1% on the second day of admission in patients with mild AP.[26] A recent randomized controlled trial has shown that, compared to late initiation, initiating oral diet at hospital admission in patients with mild/moderate AP reduces the length of hospital stay and health costs, without increasing complications.[27] The start of oral feeding is available to all centers since it does not require any special procedure. Therefore, new strategies to educate health professionals and inform patients on the benefits of early oral intake seem necessary.

The timing and type of feeding recommended by the survey participants for patients with oral intolerance in the early phase of AP also suggest room for improvement. When asked about feeding options on the second day of AP to a patient who reported vomiting, most of the participants chose not to initiate feeding by any route; 25.7% prescribed a non per oral order, and 32.8% placed a nasogastric tube; a scarce 17% started peripheral or total parenteral nutrition; and only 24.5% recommended enteral feeding via the stomach or jejunum. In the survey focused on nutrition referred to above, 33% of pancreatologists were in favor of initiating tube feeding in patients with moderate or severe AP.[26] Maintaining oral or enteral nutrition is thought to help protect the gut-mucosal barrier and reduce bacterial translocation, thereby reducing the risk of infected peripancreatic necrosis and other serious AP outcomes, although early enteral tube feeding was not superior to oral feeding at day 3 to 4 in patients with predicted severe AP.[28] For this reason, clinical guidelines advise against the parenteral route for patients who are intolerant to oral feeding and recommend enteral nutrition via nasogastric or nasoenteral tube.[11,12,14,15] Undoubtedly, the placement of a nasoenteric (gastric and jejunal) feeding tube requires the collaboration of radiologists and/or endoscopists. Perhaps this is why survey participants working within a multidisciplinary group were more likely to recommend enteral feeding. Although the scenarios proposed in the two are different, both surveys reveal a low prescription of early oral intake in patients with mild AP, and a low prescription of enteral tube feeding in patients with complicated forms of the disease. In light of the survey, proposing early oral feeding when there is oral tolerance and prescribing enteral feeding when there is none beyond day 4 of symptom onset appear as appropriate options for improvement.

It might be noteworthy that the study included a section dedicated to cholecystectomy in a survey that explicitly addressed the management of patients during the first 72 hours of illness. Certainly, cholecystectomy would not be performed within this initial period, but the question was aimed at ascertaining the usual protocol of the participants in relation to both the recommendation offered to the patient and the feasibility of surgery in their healthcare provider. Surgery in acute biliary pancreatitis has the greatest impact in avoiding a recurrent episode of pancreatitis. Cholecystectomy performed during the initial admission for patients with suspected biliary pancreatitis

is associated with substantial reduction in a composite outcome of mortality and gallstone-related complications, readmission for recurrent pancreatitis and pancreaticobiliary complications.[12,14,15] The majority of the survey participants (72.2%) recommended patients with biliary pancreatitis to undergo a cholecystectomy during index admission or within a few days after discharge. However, around a quarter of participants recommended performing a cholecystectomy few months later, or only if a second episode of AP occurs. Residents in training and fellows, nonsurgeon specialists, and participants who worked in hospitals that admitted less than 50 patients with AP per year were more likely to recommend delayed or optional cholecystectomy. In contrast, participants from Africa, North/Central/South-America, surgeons, and participants from private centers were more likely to recommend early cholecystectomy. Disseminating the benefits of early cholecystectomy and overcoming structural deficits such as specific resources, operating room availability, and lack of surgeons can be useful strategies for improvement.

In addition to examining the attitude and profile of participants in relation to the management items considered individually (fluid therapy, antibiotic prophylaxis, nutrition and feeding, and timing of cholecystectomy), we examined the profile of participants according to their degree of compliance to all the management items as a whole. According to our survey, improvement actions to increase compliance with most of the recommendations of the clinical guidelines on initial management of patients with AP should focus on professionals from Asia/Oceania, surgeons, other nongastroenterology specialists, and professionals not familiar with the number of patients admitted annually to their centers. Nonetheless, Asia and Oceania are a vast region of culturally and socially unique and diverse countries. A diversity is also found among surgeons and other professionals worldwide. Clearly, the compliance analysis of all items together generates an overly simplified snapshot of participant characteristics and it is no substitute for the richness and granularity offered by the individual item analysis above. Participants with publications in PubMed showed better compliance with most of the recommendations of the clinical guidelines. To facilitate convenient real-time availability of updated recommendations on the initial management of patients with acute pancreatitis at the point of care, and to improve adherence to the guidelines in the future, it may be useful to include them in the free downloadable GI guidelines application sponsored by the European Union of Gastroenterology, and in other support tools.

The use of social media has permeated public health research and offered scholars the opportunity to guide proposals that address unresolved issues.[29] Despite these promising avenues for research, it must be kept in mind that the recruitment of participants achieved by social media has not yet reached the level of quality offered by traditional sampling approaches.[30] Obviously, recruiting participants through social media has a potential risk of response duplication or the inclusion of general people. However, it is interesting to note that in our survey there were no differences between the responses of participants who accessed the survey through scientific associations and those who accessed through social media. This may reflect a similar level of professionalism in both groups of participants. The number of participants in our survey was not consistent with the population size of their respective countries. Thus, there was little representation from countries such as China, the US and Russia, while there was more representation from Spain and Mexico. This disparity is likely due to the fact that social media dissemination was primarily through the authors' professional contacts. However, this outreach strategy likely enhanced diversity by facilitating the contribution of participants from numerous countries not typically involved in similar studies. In principle, ours was a questionnaire of intention, not behavior, but it is difficult to predict the degree of overlap between both attitudes, and whether the questionnaire itself could modify the behavior of the participants. Only when barriers are lowered or removed do behaviors more closely resemble intentions. In this regard, the identification of demographic and professional characteristics associated with noncompliance can help reduce or eliminate some of the barriers and increase adherence to clinical guidelines.

The perspectives provided in this survey reflect the daily attitude of specialists caring for patients with AP around the world, and suggest that more improvement initiatives are needed. Despite a significant effort in the development of evidence-based guidelines through complex scientific processes, the results of this survey appear to emphasize that attention also needs to be placed on the implementation and adoption of these well-developed guidelines. Feeding and nutrition appear to require the greatest need for wider adoption, but the use of prophylactic antibiotics and timing of cholecystectomy should be improved. Awareness campaigns, medical society support and educational programs, as well as structural changes should be invested to increase the compliance of these guidelines in the initial management of patients with AP. The ultimate goal being to avoid preventable complications, and reduce mortality in a prevalent disease which still lacks specific treatment.

## CONFLICT OF INTEREST

J.-M. L: lecture honoraria from Abbott, Mylan, Nordmark. The other authors declare none related to the topic of the article.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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