

## Clinical Outcome and Prognosis of Patients with Acute Pulmonary Oedema (COPP APO)

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### Abstract

**Introduction:** Acute pulmonary oedema (APO) is associated with significant morbidity and mortality. Many published series of patients with APO are small and historical and offer only descriptive data on selected patients following acute myocardial infarction (AMI).

**Objective:** To provide a description of clinical factors and outcomes in an unselected consecutive series of patients with APO.

**Methods:** Case records were reviewed for all patients admitted to our institution with a primary diagnosis of APO in 2015. National databases were interrogated for readmission and mortality.

**Results:** 921 patients (mean age 70.99 and 70.90 years for male and female respectively with SD of 11.92 years for former and 11.95 years for latter, n=526 (63%) male, n 335 (36.3%) females) were identified. 165 patients (17%) had ejection fraction (EF>40%). Established ischemic heart disease (IHD), hypertension and diabetes were present in 61%, 83% and 55% respectively. Precipitating factors for APO included fluid indiscretion (21%) atrial fibrillation (8%), IHD (7%), infection (5%) and hypertension (4.8%). We followed these patients for 14 months +/- 8 months. The total mortality was 194 patients (21.06%) during the study period. Predictors for mortality were low EF (<35%) with high pulmonary artery systolic pressure (> 40mmHg) in the setting of AMI, sepsis and out of hospital collapse.

**Conclusion:** The outlook of APO in the present era remains substantial but may have improved from historical series.

### Introduction

Heart failure is one of the most common medical discharge diagnoses. However, heart failure, acute or chronic, is an imprecise clinical diagnosis for which there is no universally agreed definition or test. To discuss heart failure in a sensible fashion it is necessary first to consider existing and new definitions and the clinical presentations of the patients. In daily clinical practice the term 'acute heart failure' (AHF) is most often used to mean worsening breathlessness leading to breathlessness at rest when sitting upright, often considered synonymous with the term acute cardiogenic pulmonary oedema (ACPOE). This is also a frequent cause for recurrent hospital admission and can be extremely challenging to manage, requiring numerous cardiovascular drugs, sometimes coupled with mechanical circulatory / ventilatory support. Consequently, ACPOE can lead to prolonged hospital stay and associates with substantial morbidity and mortality.

Many of the published series of patients with APO are historical and offer only descriptive data on highly selected patients managed on coronary care units following presentation with acute myocardial infarction. There is therefore an important paucity of data indicating the short and long-term prognosis of this condition and limited data describing the spectrum of APO in the broader population. Moreover, little is known about the functional status of such patients and even less about their potential for rehabilitation.

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The aim of the present study therefore is to provide a description of clinical factors and outcomes in an unselected series of patients presenting with APO to a major tertiary center in Singapore.

### Definitions

Pulmonary oedema was confirmed by the presence of dyspnea, combined with pulmonary rales and or pulmonary vascular congestion on the admission chest radiograph. Recent European Society of Cardiology (ESC) guidelines suggest that the term AHF might be abandoned or should refer to new-onset heart failure regardless of its severity [1-3]. The ESC recognizes six subgroups of patients with AHF [4], but it is not clear whether this classification is practically useful [5-7].

These include:

- cardiogenic shock
- hypertensive heart failure
- heart failure with acute coronary syndrome
- isolated right heart failure
- worsening chronic heart failure and,
- ACPOE.

This is a retrospective study on ACPOE. We provide descriptive analysis of clinical factors, precipitating factors and outcomes in an unselected series of patients presenting with APO at our center in Singapore.

### Method

In this retrospective study all patient who were admitted with acute pulmonary oedema at Tan Tock Seng hospital- TTSH, Singapore from 1<sup>st</sup> Jan 2015 to 31<sup>st</sup> Dec 2015 were identified and recruited in this study. TTSH is over 1500 bedded hospital which is the one of major acute care hospital covering center of Singapore, providing all secondary and tertiary level care for most of specialties. Case records were reviewed for all patients admitted to our institution with a primary diagnosis of APO in 2015. National databases were interrogated for readmission and mortality

Inclusion / exclusion criteria are as follows: Age ≥ 18-years, with evidence of acute pulmonary oedema – i.e. pulmonary rales and/or pulmonary congestion on chest radiograph and a compatible history. Patients were excluded if they had acute coronary syndrome, concomitant fulminant sepsis, decompensated liver failure or end stage renal failure. We followed up these patients up to 14 months with +/- 8 months. Electronic records were reviewed for re admission. In case of death, cause was determined from the review of clinical case notes and official death certificate where applicable.

### Ethical approval

Approval for this study was sought from our national health group domain specific review board Singapore. We have no potential conflict of interest and all data are kept in consistent with good clinical practice and the declaration of Helsinki. Patient data was stored on password-protected

TTSH computers located within a restricted area of the cardiology service.

### Baseline assessment

In all patients, baseline demographic data along with length of stay was recorded. Detailed history and physical examination was as per our clinical records. in particular to identify data regarding onset of admission symptoms, co-morbidities, previous drug therapy and haemodynamic variables. Baseline blood investigations, including, haemoglobin, urea and electrolytes, etc. were collected. In addition, the echocardiogram was also analysed. Where image quality allows, we looked through left ventricular (LV) volumes and dimensions, LV Ejection fraction (Simpson’s biplane method preferable). Segmental left ventricular systolic function was assessed using the 16-segments method of the American Society of Echocardiography (ASE). Additional parameters were diastolic function will include septal and lateral e’ and a’, aortic valve and pulmonic valve ejection times, left atrial volumes etc. Valvular abnormalities were graded according the ASE reporting criteria. Pulmonary pressures were also recorded.

Furthermore, we also looked through the patients who presented with heart failure and or complicated by cardiogenic shock, necessitating use of inotrope, non-invasive ventilation etc., which increased the length of stay in hospital or re-admission rate.

### Results

921 patients (mean age 70.99 and 70.90 years for male and female respectively with SD of 11.92 years for former and 11.95 years for latter, n= 526 (63%) male, n 335 (36.3%) females) were identified Figure 1.

Commonest comorbidities were IHD, Hypertension and Diabetes mellitus Figure 2. Established ischemic heart disease (IHD), hypertension and diabetes were present in 61%, 83% and 55% respectively. 165 patients (17%) had ejection fraction (EF>40%) Figure 3.

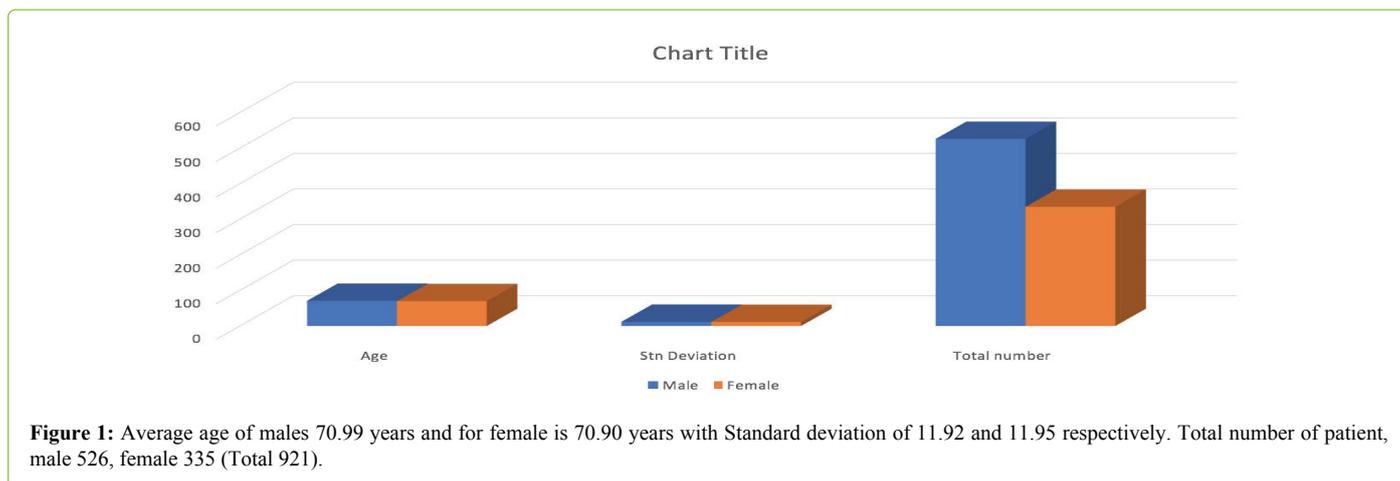
Precipitating factors for APO included fluid indiscretion (21%) atrial fibrillation (8%) IHD (7%), infection (5%), hypertension (4.8%). Others (54.2%) have combinations of more than one factors Figure 4.

We followed these patient for 14 months +/- 8 months. The total mortality was 194 patients (21.06%) during the study period. Predictors for mortality were low EF (<35%) with high pulmonary artery systolic pressure (> 40mmHg) in the setting of AMI, sepsis and out of hospital collapse Figure 5.

### Limitations

Each patient involved in this study was selected based on criteria identified with in the admission unit. Patients already admitted to hospital and developed APO later in their admission were not included. Sometime patients within our area frequently lost contact with health care services and fails to attend the follow up clinic.

Though, our center is an acute care hospital. However, this is not the only one. There are few other tertiary care hospitals with acute cardiac services in Singapore, within proximity to our catchment area. This may skew the population that attended our emergency services. Some patient



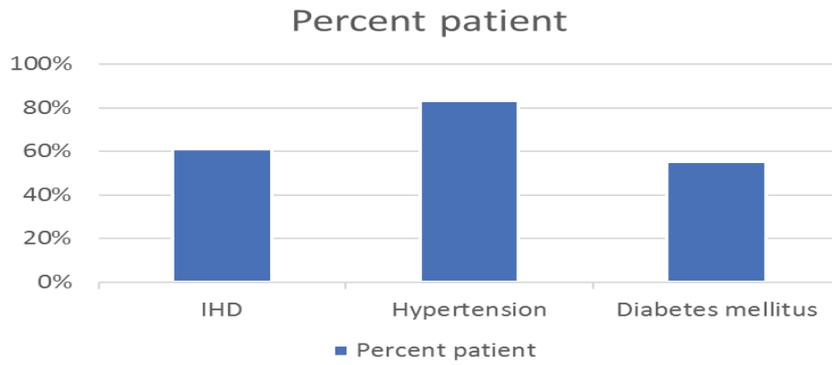


Figure 2: Common Comorbidities includes ischemic heart disease (IHD), hypertension and diabetes were present in 61%, 83% and 55% respectively.

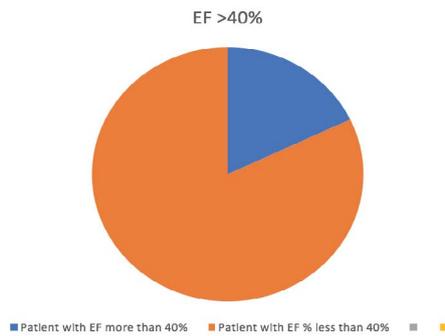


Figure 3: Ejection fraction more than 40 % noted in 165 patient and remaining 756 patient had ejection fraction of less than 40%.

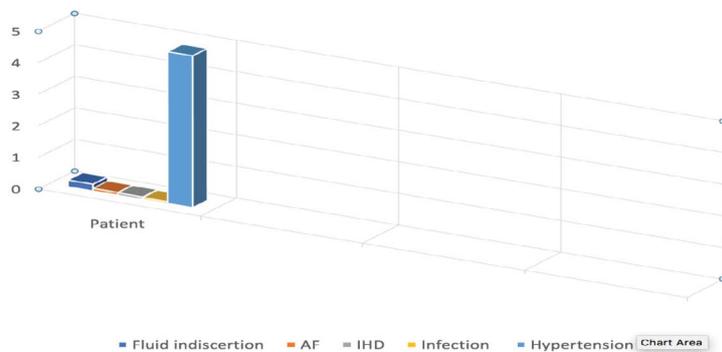


Figure 4: Precipitating factors for APO included fluid indiscretion (21%) atrial fibrillation (8%) IHD (7%), infection (5%), hypertension (4.8%) Others (54.2%) have combinations of more than one factors.

Disease	Female	Male	Total
CAD	169	403	562
Non Isch CMP	10	21	31
HfpEF	10	5	15
Cardiac amyloid	0	4	4
Unknown	85	197	282
AF	14	47	61
DM	173	331	504
Hypertension	283	480	763
Hyperlipidemia	236	427	700
COPD	29	86	115
OSA	18	12	30
Asthma	21	40	61

Figure 5: The statistically significant predictors associated with high in-hospital mortality.

may seek health care elsewhere. Nonetheless, we believe our sample to be reasonably sizeable and more representative sample could only be achieved, should a disease registry to be established.

## Conclusion

The outlook of APO in the present era remains substantial but may have improved from historical series. According to previous studies published in acute medicine journal and EHJ on long term survival of acute of acute pulmonary oedema, the mortality rate has noted to be significantly lower in our study group. It is unclear as of now the exact cause of significantly improved mortality over period. However, its presumed to be the early revascularization, increase awareness of fluid restriction and life style modification.

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