

# Mortality in Patients Over 65 with Proximal Humerus Fractures: A Systematic Review of 414,379 Shoulders with Meta-Analysis

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## INTRODUCTION:

Proximal humerus fractures (PHFs) are common in older adults with their prevalence varying from 4% to 10%. There is a progressive increase in the occurrence of PHF up to 60 years of age, whereafter the incidence levels off with high rates in those aged 60 through to 90 years old. PHFs often lead to significant morbidity for patients and are associated with an increased risk of mortality.

Compared to the treatment of hip fractures, which is firmly embedded into national and international guidelines as a frailty fracture that requires multidisciplinary treatment, no standards exist at present for PHFs. Additionally, the potential negative impact of PHFs on mortality in the ageing population ( $\geq 65$ -years) remains unclear, particularly when considering treatment strategies, comorbidities, and rehabilitation outcomes.

The primary aim of this study was to assess the mortality rate in patients  $\geq 65$ -years with PHFs at 1-year follow-up. A subgroup analysis compared mortality rates based on treatment type (operative vs. non-operative) and the mortality risk at 30-day/in-hospital, 1-year and 5-year follow-up.

## METHODS:

A systematic review and meta-analysis was performed in accordance with PRISMA guidelines. Studies were included if they reported mortality rates at 1-year, 30-days/in-hospital, or 5-years in patients  $\geq 65$ -years with PHFs. Data were analysed using a random-effects model. Subgroup analysis was performed by treatment type (operative vs non-operative).

## RESULTS:

### *Literature Search*

The literary search according to PRISMA guidelines returned 2,005 articles in total (Figure 1). There 1034 found on EMBASE, were 522 articles on PUBMED, 343 articles on SCOPUS, and 106 from MEDLINE. Following application of inclusion and exclusion criteria 16 studies were included for 30-days/in-hospital, 17 studies for 1-year mortality, and 10 for [5-year mortality](#). The majority of studies were grade III LOE ( $n=23$ ), followed by grade IV ( $n=3$ ), and lastly grade II ( $n=2$ ).

### *30-Days/In-Hospital Mortality*

Sixteen studies reported 30-days/in-hospital rates with a total of 594,295 patients. The mean mortality rate was  $2.26 \pm 1.46\%$  (0.68%-6.74%). The pooled mortality rate was 1.74% (95% CI: 1.39%-2.10%). This can be seen in the forest plot in Figure 2. Heterogeneity was high ( $I^2=98.75\%$ ).

### *1-Year Mortality*

Overall, 17 studies including 414,379 shoulders reported 1-year mortality figures. There was an average of  $82 \pm 3\%$  female with a mean age of  $78.8 \pm 2.5$  years. The mean 1-year mortality rate for these 17 studies was  $10.14 \pm 4.07\%$  (range: 3.10%-21.76%). Meta analysis of 1-year mortality for all studies ( $n=17$ ) revealed pooled estimate of 10.10% (95% CI: 8.97%-11.20%). Heterogeneity was high ( $I^2 = 98.86\%$ ). This can be visualised in Figure 3.

### [1-Year Mortality by Treatment Type \[Jv1\]](#)

When pooling the mortality data by treatment type there were seven studies which collected 1-year mortality rates in PHF who underwent non-operative treatment. There were 15 studies which collected mortality rates in those undergoing operative treatment. This was not limited by the number of shoulders. The non-operative treatment group the pooled mortality was 10.80% (95% CI: 9.44%-12.17%). For the operative treatment group the pooled mortality was 7.92% (95% CI: 6.98%-8.86%). The difference between mortality in the operative group versus was -2.89% (95% CI: -4.54% to -1.23%). This effect does not contain zero, and the CI for each group do not cross, so one can infer statistically significant differences between groups (Figure 4).

### *5-Year Mortality*

Ten studies reported long term outcomes at 5-years with a total of 262,649 patients. The mean mortality rate was  $38.85\% \pm 7.80\%$  (29.90%-55.30%). The pooled mortality rate was 36.10% (95% CI: 34.50%-37.70%) (Table 2. This can be visualised in the forest plot in Figure 5. Heterogeneity was high ( $I^2 = 97.78\%$ ). Subgroup analysis by treatment type was not performed as only two studies provided data for non-operatively managed patients.

## DISCUSSION AND CONCLUSION:

This systematic review and meta-analysis confirm that PHF at  $\geq 65$ -years is associated with a substantial and sustained mortality burden, with an overall pooled 1-year mortality of 10%. Furthermore, the 5-year pooled mortality of PHF

approaches 37%. These findings reinforce that PHFs, often perceived as lower-risk injuries compared to hip fractures, should be recognised as a major event in the lives of the elderly patient.

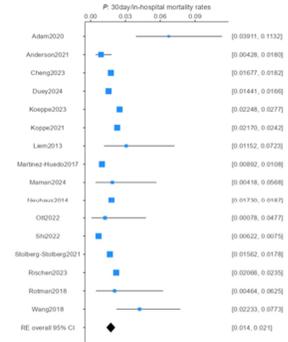
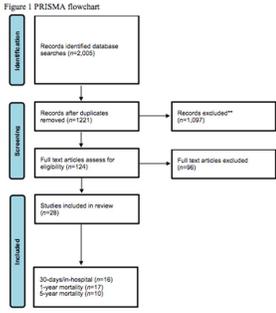


Figure 2 Forest Plot for the 30day/in-hospital mortality rates (n = 16) with individual rates displayed by blue boxes and overall pooled rates displayed by the black diamond. P = proportion, RE = random effects, CI = confidence interval

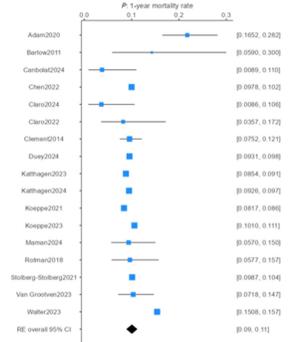


Figure 3 Forest plot for 1-year mortality rate (n = 17) with individual rates displayed by blue boxes and overall pooled rates displayed by the black diamond. P = proportion, RE = random effects, CI = confidence interval

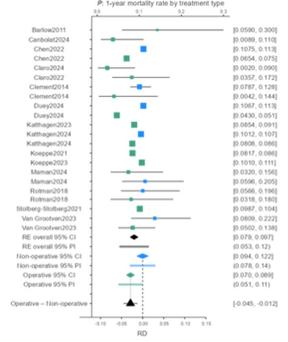


Figure 4 Forest plot for 1-year mortality by treatment group with operative in green and non-operative in blue. The squares mark individual rates, the diamond mark pooled rates, and the triangle marks difference in rates between operative and non-operative. P = proportion, RE = random effects, CI = confidence interval, RD = base difference.