

# Improving Heterogeneous Dataset Analysis: Using Published Laparoscopic Inguinal Hernia Repair (LIHR) Data

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## Background

Within published studies of LIHR, there is surprisingly great heterogeneity in data of outcome measures. Therefore, attempts to synthesise data for consensus on management is already compromised. Concepts from mathematical modelling may provide clues to improve this analysis.

**Aim:** As a proof of concept, this study aims to apply “statistical missing data” methods into the data analysis of LIHR studies, to improve reliability.

## Methodology

Using published meta-analyses of LIHR randomised controlled studies (RCT), we replicated search strategies and data analysis. Comparing published results with our replication dataset, we identified areas where data compromises must have been made. These identified areas were then compared against an a) set of observational studies and b) our own RCT dataset, to identify areas of greatest impact.

## Findings

Analysing data in 52 studies identified in 9508 patients having LIHR (total extraperitoneal approach) from 2001 to current, we identified four key areas of likely data compromise: omission (non-response), attrition, imputation and assumption (see Table 1 for definitions). The greatest differences were found in data omission and imputation, and the greatest frequency was data attrition. We found no difference in the impact of 21 randomized controlled trials compared with the pooled 31 observational studies, and in our individual RCT study dataset of 106 patients we found greatest impact could be in correcting data omission.

**Table 1.** Definition of data omission, imputation and assumption

	Definition
<b>Data omission</b>	Absence of data points which could either be the result of incomplete reporting (e.g. loss to follow-up) or exclusion of outcomes
<b>Imputation</b>	Missing data are missing at random which forms the basis of making assumptions
<b>Assumption</b>	Postulating and extrapolating missing data points to present a more comprehensive data set

## Discussion

**Data heterogeneity:** There was considerable heterogeneity in the dataset, which led to a series of assumptions that needed to be made for the pooled analysis. This feature has not been discussed in other IHR review papers, possibly due to tighter inclusion and exclusion criteria. As an initial overview, we ran a comparison between RCTs and non-RCTs to review if the less methodologically rigorous non-RCTs were skewing our results which ultimately unveiled no major differences. **Data omission and variability:** The root cause of data omission was largely related to variabilities in outcome measures. For example, there was significant inconsistency in reported pain scales and timepoints across different studies. Furthermore, quality of life measures also varied significantly among the studies, leading to many blank data points in this category. Mostly, researchers represented quality of life in terms of days required to return to normal activities and work which are not perfect estimates of quality of life. Tools specific to inguinal hernia repair, such as the Carolina Comfort Scale, could potentially provide a more accurate measure for quality of life in future studies. There was also no consistent definition used for chronic pain. Most papers included in our review did not provide a definition for chronic pain and this was also even rarely defined in meta-analysis. **Data imputation and assumption:** Given the incomplete nature of some data points, we had to resort to imputation techniques and make certain assumptions to allow for a comparative analysis. In our review, we assumed many complication rates and return to hospital and theatre rates when authors did not specifically report any. **Recommendations:** Standardising the reporting of postoperative outcomes for inguinal hernia surgeries is essential to establish a stronger foundation for future systematic reviews and meta-analyses.