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# Post-operative C-reactive protein profile following abdominal wall reconstruction with transversus abdominis posterior components separation



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## ABSTRACT

**INTRODUCTION:** Abdominal wall reconstruction using posterior component separation with transversus abdominis release (AWRTAR) produces a unique post-operative CRP profile, when compared to routine elective colorectal operations. Therefore, we aim to establish the normal post-operative C-reactive protein (poCRP) profile following AWRTAR and reduce the unnecessary invasive interventions in patients already at greater risk of septic complications.

**METHODS:** A retrospective analysis of daily poCRP levels was performed both for patients who underwent uncomplicated AWRTAR ( $n = 12$ ), and a comparator group of uncomplicated open right hemicolectomies (RH) matched for age and sex ( $n = 24$ ). All operations in both groups were performed by a single surgeon from 2013 to 2015.

**RESULTS:** The median (IQR) age was 62 (16) and 67 (16) years respectively, with a higher proportion of males to females in both groups (10:2 vs. 17:7). The poCRP profile follows an initial steep rise, peaking at day 2 followed by a gradual washout phase. The poCRP peak is significantly greater in the AWRTAR group compared to the RH group (274 [95%CI  $\pm 25$ ] vs. 160 [95%CI  $\pm 27$ ];  $p = 0.0001$ ), with a positive correlation between day 2 CRP levels and operative length ( $r = 0.56$ ).

**CONCLUSIONS:** We have demonstrated that uncomplicated AWRTAR provokes a significantly greater poCRP rise ( $>200$ ) compared to that well described in the literature for uncomplicated open colectomy. As poCRP is an important marker of post-operative recovery with abnormally high levels associated with septic complications, these data should help clinicians interpret the post-operative clinical course after AWRTAR.

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## 1. Introduction

The use of the acute phase protein, CRP, as a sensitive, non-specific marker of inflammation within surgery originates back to 1930, when two clinicians observed a rise in this protein in a patient treated for pneumonia [1]. Subsequent to this an abundance of research has evaluated its use in the timely detection of post-operative complications, with published data formulating an expected postoperative CRP profile in uncomplicated elective colorectal surgery [2].

As hernia surgery evolves and techniques such as abdominal wall reconstruction with transversus abdominis release (AWRTAR)

increase in popularity, the demand for adaptive research is ever growing. It has been previously suggested that CRP values in elective colorectal cases maintained above 130 mg/l beyond the second postoperative day should be investigated to aid the early detection and treatment of potential complications [2]. Despite the familiarity with these post-operative trends within our elective colorectal practice, when we observed CRP values of this magnitude in our AWRTAR patients we were concerned about the possibility of a significant intra-abdominal complication. When this did not transpire and these patients were later discharged free from complications, we felt this observation warranted further research to help guide the post-operative management, as re-laparotomy in this patient group carries considerable risk.

To our knowledge this is the first investigation of this phenomenon in this patient group. We hypothesised that we would detect significantly greater post-operative CRP values following uncomplicated AWRTAR surgery than elective open colorectal surgery.

**Abbreviations:** AWRTAR, abdominal wall reconstruction using posterior component separation with transversus abdominis release; poCRP, post-operative C-reactive protein; RH, right hemicolectomy.

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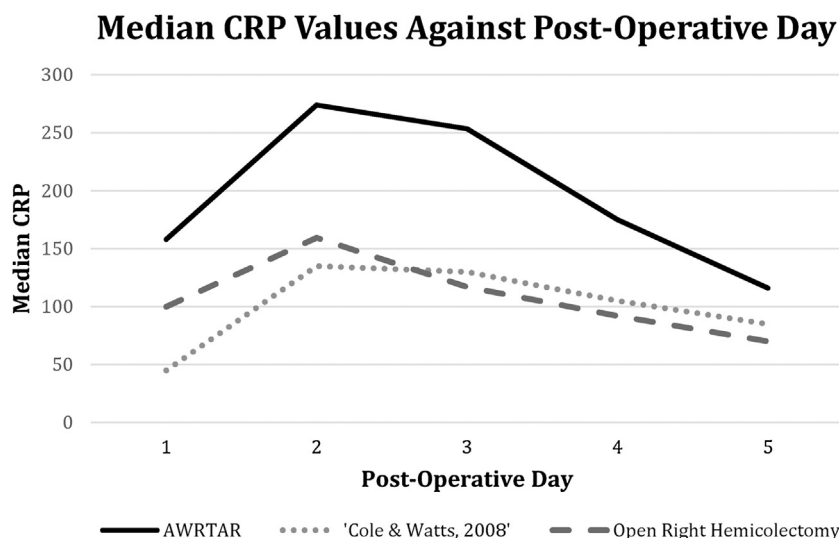


Fig. 1. Median CRP values post-operatively for abdominal wall reconstruction (AWRTAR), right hemicolectomy (RH), and Cole and Watts [2].

## 2. Material and methods

Within this case series we performed a retrospective analysis of post-operative CRP values (daily for 5 days) within 12 AWR TAR patients, all of whom were discharged without complication. We compared these to a demographically matched control group of 24 patients who underwent open right hemicolectomy. All operations were laparotomies performed by the same consultant surgeon at the same hospital between 2013 and 2015. Patients with a prolonged period of stay (>7 days) or surgical complications were excluded (> Grade I Clavien-Dindo classification). CRP was measured in the Department of Biochemistry at Arrowe Park Hospital using a turbidometric immunoprecipitation assay on a Roche Cobas 8000 analyser, represented as mg/l. Operation length was collected as a secondary data finding within the AWR TAR group. Statistical analysis was performed on post-operative CRP values using the Mann-Whitney *U* test and operation length vs. day 2 CRP values using Spearman's correlation coefficient. Statistically significant differences were represented as  $p < 0.05$ .

In accordance with the declaration of Helsinki, the research registry number is: 2690. Ethical approval was not needed for this case series as this is a retrospective analysis with no intervention resulting in the deviance of standard clinical practice. Fully anonymised data.

This work has been reported in line with the PROCESS criteria [3].

## 3. Results

The median (IQR) age was 62(16) and 67(16) years in the AWR TAR and right hemicolectomy groups respectively, with a higher proportion of males to females in both groups (10:2 vs. 17:7).

Our control group, undergoing uncomplicated open right hemicolectomy, demonstrated a peak in median CRP at day two of 160 mg/l [95%CI  $\pm$  27]. CRP values subsequently decreased gradually into day five. In patients undergoing uncomplicated AWR TAR, post-operative CRP values exhibit a steep initial rise, also peaking at day two with a CRP value of 274 mg/l [95%CI  $\pm$  25], followed by a gradual washout phase into day five (Fig. 1). Absolute CRP values are higher in the AWR TAR group at all time points, reaching statistical significance on days two ( $p = 0.0001$ ), three ( $p = 0.001$ ) and four ( $p = 0.07$ ; Table 1).

Table 1

Median (IQR) CRP values at each postoperative day.

Post-operative day	Median (IQR) CRP AWR TAR	Median (IQR) CRP Open Right Hemicolectomy	p-value (Mann-Whitney <i>U</i> test)
1	157 (74)	100 (61)	0.059
2	274 (60)	160 (55)	0.0001*
3	254 (63)	117 (45)	0.001*
4	175 (81)	92 (43)	0.007*
5	116 (81)	70 (35)	0.063

\* denotes statistical significance [ $p < 0.05$ ].

The median (IQR) operative length of the AWR TAR group was 340 (97) minutes. There was a positive correlation between day 2 post-operative CRP values and operative length ( $r = 0.56$ ).

## 4. Discussion

Our data suggest that patients undergoing AWR TAR provoke a significantly greater post-operative inflammatory response when compared to routine elective colorectal operations. Our control group, undergoing open right hemicolectomy, demonstrated a post-operative CRP profile of similar dynamics to Cole and Watts' published data [2].

One possible explanation for this finding is the difference in the degree of surgical dissection performed and the inflammatory response that it provokes. A surrogate marker of this is operative length, which we have shown is greater in AWR TAR operations. As a result, the extensive soft tissue dissection that comprises AWR TAR, and longer operative length, likely correlates with the intensity and duration of the acute phase stimulus and ultimately the number of hepatocytes producing CRP [4].

Pre-operative measurement of CRP values is routine in elective colorectal operations and considered a helpful prognostic indicator, with raised pre-operative CRP values indicating a greater risk of post-operative complications [5]. However, this is of less prognostic use within AWR TAR patients, where despite the lower pre-operative inflammatory stimulus, we were still seeing day 1 CRP values greater than that in our control group. These results would not support the practice of mandatory pre-operative CRP testing in AWR TAR patients.

These findings have important clinical implications where the demonstrated post-operative CRP profiling following AWR TAR can facilitate the early detection of potential septic complications.

Furthermore, clinician's awareness of higher post-operative CRP values within these patients can result in the avoidance of unnecessary radiological imaging, or ultimately, re-laparotomy and its associated morbidity.

A potential limitation of our study was the small sample size. The technique of AWRTAR is still gaining momentum, and very few units worldwide will have very large numbers on which to report. It is clear however that despite this the data conveys and justifies the useful clinical conclusions we have drawn.

## 5. Conclusion

Early identification of post-operative complications is particularly important in AWRTAR patients, not just because of the potential for intra-abdominal collections and associated sepsis but because of the implications and risks associated with re-laparotomy. In patients undergoing uncomplicated AWRTAR surgery, unusually high peak CRP values are seen on day two and remain higher than expected over subsequent days in the absence of complications. Clinicians should take these findings into account when assessing AWRTAR patients postoperatively. We believe this preliminary research into an increasingly popular technique warrants further investigation with larger sample sizes and the possible consideration of data collection on a prospective basis to measure outcomes in complicated cases.

## Conflicts of interest

Nil.

## Funding

Nil.

## Ethical approval

Not needed.

## Consent

Consent is not necessary for this case series as all data are anonymous laboratory values, age, gender and operation lengths. There is no patient identifiable or sensitive information within this manuscript.

## Author contribution

Mr C Walsh – research lead.

Mr A Pearce – primary author, data collection and data analysis.

Mr L Thornton – author, data collection and data analysis.

Mr P Sutton – author, study concept and data analysis.

## Registration of research studies

Research registry.

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## Guarantor

Alexander Pearce.

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