

# Quantifying the effect of patient position on the curvature of colons

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**INTRODUCTION:** Colonoscopy is a complex procedure with considerable variation among patients, requiring years of experience to become proficient. Understanding the curvature of colons could enable practitioners to be more effective. Position change for extubation has been found to increase the rate of adenoma detection, while adding just 44 seconds to the procedure and being cost neutral[1]. Therefore, positional recommendations could be made during intubation to increase patient comfort and ease of operation. The purpose of this research is to develop methods to analyze the curvature of patients' colons, and compare key segments of colons between supine and prone positions.

**METHODS:** The colon lumen in CT scans of ten patients are segmented. The following steps are automated by Python scripts in the 3D Slicer application: generate centerline points of the colon, fit a curve to the center points, and compute the curvature at every point along the curve. With point curvature data, we can identify the maximums and minimums in curvature. Curves are defined between two local curvature minimums. Angle of curves is calculated over the distance of curves by the angle between the vectors from local curvature minimum to curve maximum, and from the maximum to the next minimum.

**RESULTS:** This automated process identifies curves on the colon centerline for quantitative analysis in different patient positions. On average, there are  $4.6 \pm 3.8$  more curves in supine position than prone. In the descending colon, there is a mean of  $3.7 \pm 3.7$  curves more in the supine position. In the descending colon, prone curves turn a mean of  $6.2 \pm 8.8$  degrees more than supine curves.

**CONCLUSION:** Our process identified and quantified curves in the colons of ten patients' CT scans to reveal more curves in patients' colons in the supine position, especially in patients' descending and sigmoid colons. It is also observed that curves in the descending colon are of a higher degree in the prone position. With the data provided in this study, and with the future data collected from a study with a larger sample size, physicians will have a better idea of the typical curvatures of colons, to aid them in colonoscopy.

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## REFERENCES:

- [1] A. Wilson MRCP and B. P. Saunders FRCP, "Position change during colonoscopy: the oldest and best trick in the book," *Gastrointest. Endosc.*, vol. 82, pp. 495–496, 2015.

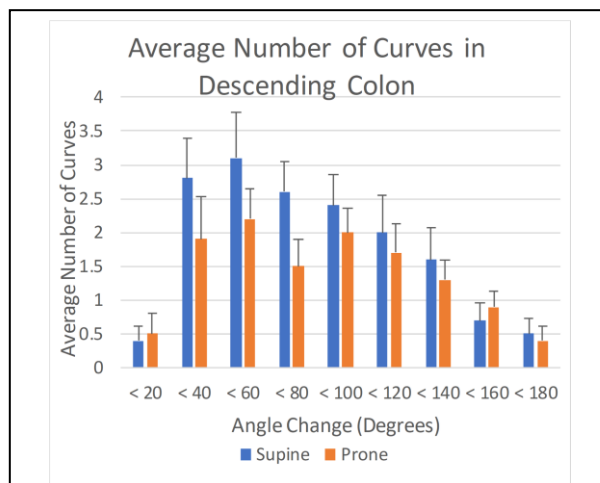


Figure 1. Histogram of the average number of curves ( $\pm$ SEM) in the descending colon per degree interval, with degree intervals of 20 degrees.

Table 1. Mean ( $\pm$ SEM) Number of Curves in Each Segment by Position.

Mean Number of Curves	Supine	Prone
Whole Colon	$33.5 \pm 2.1$	$28.9 \pm 1.7$
Ascending Colon	$2.6 \pm 0.3$	$3.0 \pm 0.7$
Transverse Colon	$14.8 \pm 1.5$	$13.5 \pm 1.2$
Descending Colon	$16.1 \pm 2.0$	$12.4 \pm 1.7$