

## ORIGINAL COMMUNICATION

# Locating the Arcuate Line of Douglas: Is It of Surgical Relevance?

P.M. MWACHAKA,\* H.S. SAIDI, P.O. ODULA, K.O. AWORI, AND W.O. KAISHA

*Department of Human Anatomy, University of Nairobi, Nairobi, Kenya*

Ventral hernia formation is a common complication of rectus abdominis musculocutaneous flap harvest. The site and extent of harvest of the flap are known contributing factors. Therefore, an accurate location of the arcuate line of Douglas, which marks the lower extent of the posterior wall of the rectus sheath, may be relevant before harvesting the flap. This study is aimed at determining the position of the arcuate line in relation to anatomical landmarks of the anterior abdominal wall. Arcuate lines were examined in 80 (44 male, 36 female) subjects, aged between 18 and 70 years, during autopsies and dissection. The position of the arcuate line was determined in relation to the umbilicus, pubic symphysis, and intersections of rectus abdominis muscle. Sixty four (80.4%) cases had the arcuate line. In most cases (52), this line was located in the upper half of a line between the umbilicus and the pubic symphysis. Most males (93%) had the arcuate line, while more than a third of females did not have it. In all these cases, the line occurred bilaterally as a single arcade, constantly at the most distal intersection of the rectus abdominis muscle. Consequently, the arcuate line is most reliably marked superficially by the distal tendinous intersection of the rectus abdominis muscle. Harvesting of the muscle cranial to this point will minimize defects in the anterior abdominal wall that may lead to hernia formation. *Clin. Anat.* 23:84–86, 2010. © 2009 Wiley-Liss, Inc.

**Key words:** rectus abdominis flaps; hernia; umbilicus; pubic symphysis

## INTRODUCTION

The arcuate line of Douglas is a sharp concave line that occurs bilaterally, midway between the umbilicus and the pubic symphysis (William et al., 1995; Sinnatamby, 2000). Some studies have, however, shown that the occurrence as well as the number of this line varies. Absence of this line has been reported in up to 15% of the cases (Rizk, 1991). Ipsilateral double arcades have been reported in 15–47% of cases (Rizk, 1991; Rath and Zhang, 1997). The position of this line in relation to the umbilicus and pubic symphysis has also been documented as variable with the highest being at the level of the umbilicus and the lowest near the pubic crest (Rizk, 1991; Cunningham et al., 2004; Monkhouse and Khalique, 1986). In a high position of the arcuate line, the rectus abdominis muscle lies only on trans-

versalis fascia (William et al., 1995; Sinnatamby, 2000).

Hernia formation in the anterior abdominal wall is a common complication of rectus abdominis musculocutaneous flap harvest (Cunningham et al., 2004). The site and extent of harvest of the flap have been shown to contribute in the occurrence of this complication. Thus, an accurate location of the arcuate line of Douglas, which marks the lower extent of the pos-

\*Correspondence to: Philip Maseghe Mwachaka, Department of Human Anatomy, University of Nairobi, P. O. Box 30197-00100 GPO, Nairobi, Kenya. E-mail: pmaseghe@yahoo.com

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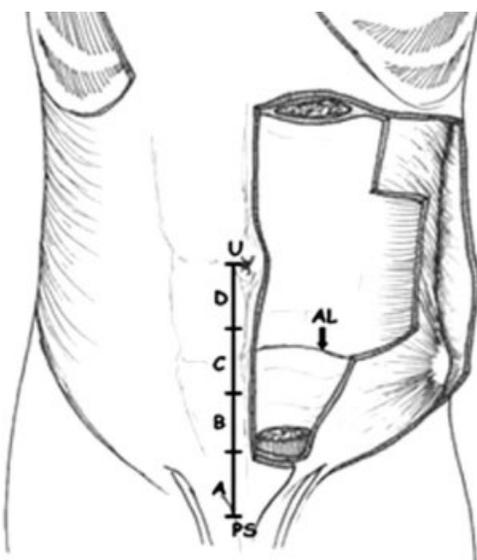
terior wall of the rectus sheath, may be relevant before harvesting the flap. Harvesting the rectus abdominis muscle below the arcuate line creates a potential defect in the anterior abdominal wall that may predispose to herniation.

This study describes the position of the arcuate line in relation to anatomical landmarks of the anterior abdominal wall.

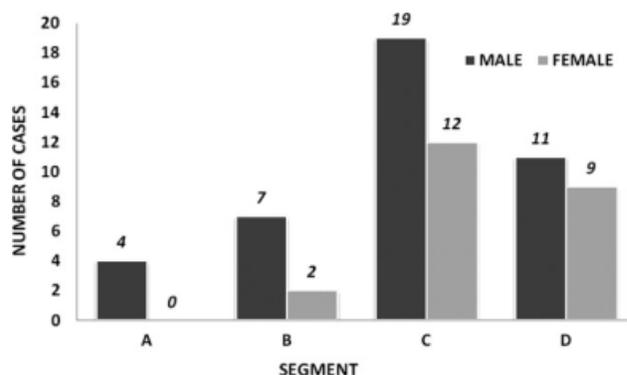
### MATERIALS AND METHODS

Eighty subjects aged 18 to 70 years were used for the study. Of these, 31 (16 male, 15 female) were studied during autopsies at the Nairobi's City and Chiromo Mortuaries. The remaining 49 (28 male, 21 female) were cadavers used for routine dissection by first year medical students at the Department of Human Anatomy, University of Nairobi.

The rectus sheath was displayed after a midline abdominal incision. A single paramedian incision was made on each side from the costal to the pubic attachments of the rectus sheath. The posterior wall of the sheath was then inspected for the presence of the arcuate line. When the arcuate line was present, its position was determined by dividing the distance between the pubic symphysis and the umbilicus into four equal segments A, B, C, and D, from the pubic symphysis upwards (Fig. 1). The position of the arcuate line was also related to the tendinous intersections of the rectus abdominis muscle. The data collected were coded then entered into Statistical Package for Social Sciences software (version 15.0, Chicago, Illinois) for statistical analysis. A *P*-value  $\leq 0.05$  was considered significant.



**Fig. 1.** Anterior view of the anterior abdominal wall showing location of the arcuate line (AL). PS, pubic symphysis; U, umbilicus.



**Fig. 2.** Location of the arcuate line in the different segments among males and females. Note that most of the arcuate lines were located in the upper half of the area between the umbilicus and pubic symphysis (segments C and D).

### RESULTS

Arcuate line of Douglas was present in 64 (80.4%) cases. Although most of the males (41 out of 44) had arcuate lines, only 63.9% (23) of the female cases had the line. In each of these cases, it occurred bilaterally as a single structure, and was consistently found at the most distal intersection of the rectus abdominis muscle. In most cases (52), the arcuate line occurred in the upper half of the area between the umbilicus and the pubic symphysis (Fig. 2). Although none of the females had their arcuate lines in segment A, this was not statistically significant (*P* = 0.308).

### DISCUSSION

Ventral hernia formation after rectus abdominis musculocutaneous flap harvest is influenced by the extent and site of harvest of the flap. An accurate knowledge of the anterior abdominal wall anatomy would therefore help the surgeon choose where to incise and thus may minimize the occurrence of this complication.

The arcuate line of Douglas, in the present and in previous studies, was seen in most of the cases. Ethnic variations in the prevalence of this line have been reported. Among the British and French, the line was present in all cases (Rath and Zhang, 1997; Monkhouse and Khalique, 1986). The prevalence among Americans and Iraqis was 94% and 85%, respectively. Although our study revealed the lowest incidence of this line, the majority of the cases studied had the arcuate line. Thus most individuals have weak anterior abdominal walls and will have higher chances of developing hernias if rectus abdominis musculocutaneous flaps harvest extends below the arcuate line.

Muscle fibres from the posterior wall of rectus sheath usually shift to the anterior wall from the umbilicus towards the pubic crest. When the shifting

ends abruptly, a sharp crescentic line, the arcuate line, is formed (Rizk, 1991). Because presence of the arcuate line limits the inferior extent of rectus abdominis flap harvest, individuals without the line (who were more in the current study when compared with previous studies) are likely to suffer less ventral hernial formations. In this study, more than a third of the females did not have the line. Anterior abdominal walls in these cases are therefore stronger, and may be an adaptation for bearing large intra-abdominal pressures seen in women.

It was noted that the arcuate line was closer to the umbilicus than the pubic crest. These findings are in accord with those among Americans (Cunningham et al., 2004) but are at variance with the previous descriptions that the arcuate line consistently occurs midway between the umbilicus and pubic symphysis (William et al., 1995; Sinnatamby, 2000). The observation that the arcuate line may occur more cranial suggests that the shifting of these fibres from the posterior wall of the rectus sheath may be influenced by the form of the rectus abdominis muscle. Pertinent to this, in the present study, a more consistent landmark for this line was the most distal intersection of rectus abdominis muscle. In this regard, the last tendinous intersection of rectus abdominis muscle may be used as a guide for the arcuate line during rectus abdominis musculocutaneous harvest.

Although the arcuate line in the current study occurred as a single structure in all cases, some studies have reported double arcades (Rizk, 1991; Rath and Zhang, 1997). These workers attributed the presence of double arcuate lines to the fact that the deep lamina of internal oblique abdominis crosses to the anterior wall of the rectus sheath at a higher point than the transversus abdominis. The upper arcade would then be formed by the aponeurosis of internal oblique abdominis muscle while the lower one would be formed by transversus abdominis muscle (Rath and Zhang, 1997).

## CONCLUSION

Most individuals have an arcuate line, therefore, they have higher chances of developing ventral hernias following rectus abdominis musculocutaneous flap harvest, if the flap is obtained below this line. Location of the arcuate line of Douglas is thus important to aid the surgeon in choosing where to incise during the flap harvest. Our study has shown that the arcuate line is most reliably marked superficially by the distal tendinous intersection of the rectus abdominis muscle. Harvesting of the muscle cranial to this point will create fewer defects in the anterior abdominal wall and consequently less chances of hernia formation.

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