



Original article

Dukes' staging is poorly understood by doctors managing colorectal cancer

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Objective: This study set out to investigate the current understanding of Dukes' staging for colorectal cancer.

Design: A questionnaire was distributed to surgeons and general practitioners attending colorectal meetings asking for a definition of Dukes' stages A, B and C. Results were analysed blind by two authors jointly to assess accuracy as correct, within definition, or incorrect. Within definition was defined as a description fitting within but not covering all tumours within that stage.

Results: 128 answers were received from 48 GPs, 7 final year medical students, 38 house officers and SH0s, 19 higher surgical trainees and 16 consultants. Overall, 3.9% defined all three stages correctly and 13.3% got all three definitions incorrect. Correct stages were Dukes' A 7.8%, Dukes' B 16.4% and Dukes' C 29.7%. Two consultants (12.5%) achieved three correct definitions, as did two HSTs (10.5%). No GPs had all three stages correct and 10 (20.8%) were wrong in all three. If those said to be within definition were considered right, 35.1% were correct for all three stages with 76.6% getting Dukes' A correct, 46.9% Dukes' B and 56.6% Dukes' C.

Conclusions: Dukes' staging is, therefore, still poorly understood by doctors managing patients with colorectal cancer. The introduction of proformas will reduce the reliability upon memory for this and more complex staging classifications.

Key words: Dukes – Staging – Colorectal – Cancer

Ever since Dukes, a pathologist at St Mark's Hospital in London, published a staging system for rectal cancer in 1929,¹ the importance of staging in this disease has not been disputed. It is necessary to give the patient advice about the prognosis and also helps medical staff in the decision as to whether adjuvant radiotherapy and/or chemotherapy should be offered. Since the mid-1930s, Dukes' staging system has been applied to colonic cancer, as well as rectal, and more complicated staging systems have been developed, needing more information and more facts to be remembered. We, therefore, decided to

study the understanding doctors, who are involved in the management of colorectal cancer patients, have of the Dukes' staging system,

Materials and Methods

A questionnaire was distributed to surgeons and general practitioners attending colorectal meetings asking for a definition of Dukes' stages A, B and C. The results were analysed blind by two authors (KSM and BFW), jointly, to assess accuracy as correct, within definition, or incorrect.

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Table 1 Distribution of answers by medical post held

	No. of answers	All 3 correct	All 3 wrong	A correct	B correct	C correct
General practitioner	48	0	10	4	13	11
Medical student	7	1	1	1	4	2
House officer	8	0	2	2	2	0
Senior house officer	30	0	2	18	14	10
Specialist registrar	20	2	1	8	13	11
Consultants						
Non-colorectal	14	1	1	4	8	7
Colorectal	2	2	0	2	2	2

Within definition was defined as a description fitting, but not covering all, tumours within that stage. Each answer was classified for Dukes' staging in 1929, 1932 and then the modification in 1949 by Kirklin.

Results

A total of 150 questionnaires were distributed with 128 answers received from 48 of 59 GPs, 7 of 12 final year medical students, 38 of 40 house officers and SHOs, 19 of 21 higher surgical trainees and 16 of 18 consultant surgeons (Table 1).

Overall, 3.9% defined all three stages correctly and 13.3% got all three definitions incorrect. Correct stages were Dukes' A 7.8%, Dukes' B 16.4% and Dukes' C 29.7%. Two consultants (12.5%) achieved three correct definitions, as did two HSTs (10.5%). No GPs had all three stages correct and 10 (20.8%) were wrong in all three (Table 1).

If those said to be within definition were considered right, 35.1% were correct for all three stages with 76.6% getting Dukes' A correct, 46.9% Dukes' B and 56.6% Dukes' C (Table 2).

For surgeons having passed their FRCS (SpRs and consultants), only 5 of the 36 (13.9%) completing the questionnaire were correct for all three stages and 2 of the 36 (5.5%) were incorrect for all three stages.

Discussion

In the 1920s, Lockhart-Mummery² looked at 200 cases of rectal cancer and devised a clinical staging system, which Dukes developed into a staging system for rectal cancer in which the depth of invasion and absence or presence of lymph node metastases was important.¹ Much of the confusion surrounding the staging of colorectal cancers arises from Dukes himself, as in 1929 he proposed that stage A be applied to a malignant tumour which extended into the submucosa, but not into the muscle coat. Stage B extended into the muscle coat but not into the perirectal tissues directly and stage C spread by direct continuity into the perirectal tissues (Table 3).

In 1932, Dukes then modified his staging system³ so that stage A was defined as limited to the wall of the rectum, B spread directly into the extrarectal tissues and C was

Table 2 Results of the questionnaire responses

All three Dukes' stages correct	6/128	4.6%
All three Dukes' stages wrong	17/128	13.3%
A correct	39/128	35.1%
B correct	56/128	48.4%
C correct	43/128	38.3%

Table 3 Dukes' 1929 classification

A	A malignant tumour in which growth extends into the submucosa, but not into the muscle coat
B	The tumour growth extends into the muscle coat, but has not spread by direct continuity into the perirectal tissues
B1	The circular muscle coat is the limit of growth
B2	The longitudinal muscle has been reached
C	Malignant tumour which has spread by direct continuity into the perirectal tissues

Table 4 Dukes' 1932 classification with 1935 modification

A	Growth limited to the wall of the rectum
B	Extension of growth to extrarectal tissues but no metastases in regional lymph nodes
C	Metastases in regional lymph nodes
C1	Regional lymph nodes positive
C2	Lymph nodes at the point of mesenteric blood vessel ligation involved

defined as the presence of lymph node metastases. This was developed further in 1935 by Gabriel, Dukes and Bussey,⁴ when stage C was subdivided into C1 where only regional lymph nodes were involved and C2 when lymph nodes at the point of the mesenteric vessel ligation were involved (Table 4). This is what is known as the full Dukes' classification. It was soon realised that this was prognostically useful and equally applicable to colonic cancer.⁵

Unfortunately, two other staging systems were then published which were modifications of Dukes' system; however, they were confused with it and even had Dukes' name misapplied to them. The first was that produced by Kirklin and colleagues in 1949,⁶ where stage A had to be confined to the mucosa, stage B1 involved the muscularis propria but did not penetrate it, B2 penetrated the

Table 5 Astler and Collier staging system

A	Cancer limited to the mucosa
B1	Cancer involves the muscularis propria but does not penetrate through it
B2	Cancer penetrates through the muscularis propria
C1	Cancer still confined to the bowel wall with lymph node metastases
C2	Cancer penetrates the bowel wall with lymph node metastases

muscularis propria and C had involved lymph nodes. Then, in 1954, Astler and Collier⁷ modified the Kirklin system by subdividing the lymph node involvement into C1 when the tumour was confined to the wall with positive lymph nodes and C2 when the wall was penetrated by tumour, which also involved lymph nodes (Table 5). In our study, the majority of respondents who described Dukes' stage A incorrectly said that the tumour was confined to the mucosa, thus missing some of the Dukes' A tumours, and the Kirklin system may be responsible for this confusion.

It is difficult to understand the confusion with Dukes' stage C tumours as lymph node involvement is necessary to stage a tumour as C in all the above staging systems, except Dukes' 1929 classification, which itself is not widely quoted in modern publications.

The TNM staging system is the current staging system, which is gaining widespread use since its initial description in 1954 by Denoix⁸ and adaptation to colorectal cancer by Beahrs and Myers.⁹ However, this system is more complicated than the Dukes' system, requiring many more facts in order to stage a patient's cancer. This system has already undergone three modifications since 1983 making the clinician's task of remembering the scoring more difficult.

Another factor we believe is partly responsible for the lack of accurate understanding of the Dukes' classification is the wide disparity in the commonly used textbooks of surgery and pathology in what the staging system is. For instance several describe the Dukes' staging system using the 1935 modification,¹⁰⁻¹⁴ whereas others quote the 1932 classification¹⁵⁻¹⁸ and some misquote Dukes and mix up his classifications with the aforementioned later modifications.^{19,20}

We hope that lessons will be learned from the confusion around Dukes' staging so that the TNM staging system will be accurately applied and few modifications made to it. The introduction of proformas should also decrease the reliance upon memory of the relevant staging classifications.

Therefore, accurate comparison of treatments for like stages can be implied from trials and the patients will benefit from the medical staff having a full understanding of the staging system in use.

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References

- Dukes C. The spread of cancer of the rectum. *Br J Surg* 1929-30; **17**: 643-8.
- Lockhart-Mummery JP. Two hundred cases of cancer of the rectum treated by perineal excision. *Br J Surg* 1926-27; **14**: 110-24.
- Dukes C. The classification of cancer of the rectum. *J Pathol Bacteriol* 1932; **35**: 323-32.
- Gabriel WB, Dukes C, Bussey HJR. Lymphatic spread in cancer of the rectum. *Br J Surg* 1935; **23**: 395-413.
- Grinnell RS. The grading and prognosis of carcinoma of the colon and rectum. *Ann Surg* 1939; **109**: 500-33.
- Kirklin JW, Dockerty MB, Waugh JM. The role of the peritoneal reflection in the prognosis of carcinoma of the rectum and sigmoid colon. *Surg Gynaecol Obstet* 1949; **88**: 326-31.
- Astler VB, Collier FA. The prognostic significance of direct extension of carcinoma of the colon and rectum. *Ann Surg* 1954; **139**: 846-51.
- Denoix P. *French Ministry of Public Health National Institute of Hygiene Monograph No. 4*. Paris, 1954.
- Beahrs OH, Myers MD. *American Joint Committee on Cancer. Manual for Staging of Cancer*, 2nd edn. Philadelphia, PA: Lippincott, 1983.
- Kettlewell M. Colorectal cancer and benign tumours of the rectum. In: Morris PJ, Malt RA. (eds) *Oxford Textbook of Surgery*. Oxford: Oxford University Press, 1994; 1064.
- McLatchie G. *Oxford Handbook of Surgery*. Oxford: Oxford University Press, 1990; 571.
- Mann CV, Russell RCG, Williams NS. *Bailey and Love's Short Practice of Surgery*, 22nd edn. London: Chapman and Hall, 1995; 853.
- Cushieri A, Giles GR, Moosa AR. *Essential Surgical Practice*, 3rd edn. Oxford: Butterworth-Heinemann, 1995; 1383.
- Burkitt HG, Quick CRG, Gatt D. *Essential Surgery: Problems, Diagnosis and Management*, 2nd edn. Edinburgh: Churchill Livingstone, 1996; 302.
- Underwood JCE. *General and Systematic Pathology*. New York: Churchill Livingstone, 1996; 290.
- Dunn DC, Rawlinson N. *A Guide to General Surgical Care*, 2nd edn. Oxford: Blackwell Science, 1991; 360.
- Hope RA, Longmore JM, Hodgetts TJ, Ramrakha PS. *Oxford Handbook of Medicine*, 3rd edn. Oxford: OUP, 1993; 140.
- McGee JO'D, Isaacson P, Wright NA. *Oxford Textbook of Pathology*, vol 2a. Oxford: OUP, 1992; 1267.
- Forrest APM, Carter DC, McLeod IB. *Principles and Practice of Surgery*, 3rd edn. Edinburgh: Churchill Livingstone, 1995; 432.
- Burkitt HG, Stevens A, Lowe JS, Young B. *Wheater's Basic Histopathology*, 3rd edn. New York: Churchill Livingstone, 1996; 153.