

The HULL Score

Background

Unsuspected pulmonary embolism (UPE) is defined as a pulmonary embolism diagnosed on a computed tomography (CT) scan performed for other reasons than a clinical suspicion of pulmonary embolism. Over the past 20 years there has been an increase of UPE reporting particularly in cancer patients. This has been due to the introduction of multidetector CT scanner technology and whole-body CT scan having become the standard of care for the diagnosis, surveillance, staging and restaging of people with cancer. A recent meta-analysis of 12 studies including over 10,000 patients reported a weighted mean prevalence of UPE in cancer patients of 3.1% compared to 2.5% in non-cancer patients while the incidence can range broadly from 1% to 15% or higher depending on cancer population characteristics.

The identification of a UPE on a scan in ill inpatients has no substantial impact on health consumption or diagnostic delay, nor has the confirmation of a PE on computed tomography pulmonary angiogram in cases of suspected pulmonary embolism. The converse is true for ambulatory cancer patients that have a UPE identified on their staging, surveillance or treatment response scans.

These scans are often reported with delay on routine radiology lists, they are often reported to emergency medicine teams not involved with the patients' usual care, assessment is often done using generic means (e.g. the PESI score) or no means at all and more often than not patients are admitted for anticoagulant treatment following unsuitable standard operating procedures or guidelines for pulmonary embolism, resulting in patient distress due to unexpectedness of diagnosis, and substantial increments in health care consumption due to inappropriate admissions.

The HULL Score

The HULL Score is the result of 14 years of work using a bespoke pathway [1] developed for and run by allied health professionals (nurses, pharmacists) studying the utility of generic tools and finally developing [2] and validating [3, 4] a simple bespoke tool, the HULL Score.

The score consists of immediately available information on the activities of daily living (performance status) as assessed and scored by the ECOG scale and 2 specific questions designed to elicit relevant symptoms. This score can be delivered easily in a busy acute unit, can be used as triage by radiographers at a radiology department **and importantly, assessed even over the phone**, a common situation given that the majority of the patients are informed days later. We have shown that the score can stratify cancer patients with UPE safely and effectively, and in the Hull University Teaching Hospitals NHS Trust's experience (more than 800 patients to date), lead to safe outpatient management of more than 80% of ambulatory patients.

The score stratifies early and medium term mortality outcomes of ambulatory patients with cancer and an UPE. In the Hull University Teaching Hospitals NHS Trust patient cohort, the HULL score was used to effectively stratify the 30-day (3.4%, n = 8), 3 month (15%, n = 35) and 6 month (31%, n = 72) mortality [2].

When to use:

- Adults (≥ 18 years)
- The patient has active cancer, is receiving adjuvant treatment, or is on long-term surveillance for cancer.
- Pulmonary embolism diagnosis is made on a CT scheduled to assess tumour response, surveillance or for other reasons.
- **The patient is ambulatory being managed in an outpatient setting.**

When not to use:

- The UPE is found on a CT scan done in an acutely unwell patient in the inpatient setting.

Why to use:

- The objective of this tool is to classify cancer patients with PE who are safe to be managed as outpatients.

Table: The HULL Score: This simple prognostic score based on patient reported clinical factors (symptom assessment and contemporaneously assessed performance status) can be used to easily and reliably stratify the mortality outcomes of cancer patients with UPE.

Variable	Categories	Points
New or worsening symptoms	Yes	1
	No	0
Performance Status	0	0
	1/2	2
	3/4	3
Scoring:		
<ul style="list-style-type: none">• Low Risk: 0• Intermediate Risk: 1 – 2• High Risk: 3 – 4		

References

[1] Palmer J, Bozas G, Stephens A, Johnson M, Avery G, O’Toole L, Maraveyas A. Developing a complex intervention for the outpatient management of incidentally diagnosed pulmonary embolism in cancer patients. BMC Health Serv Res. 2013 Jun 27;13:235.

[2] Bozas G, Jeffery N, Ramanujam-Venkatachala D, Avery G, Stephens A, Moss H, Palmer J, Elliott M, Maraveyas A. Prognostic assessment for patients with cancer and incidental pulmonary embolism. Thromb J. 2018 Feb 6;16:8.

[3] Maraveyas A, Kraaijpoel N, Bozas G, Huang C, Mahé I, Bertolotti L, Bartels-Rutten A, Beyer-Westendorf J, Constans J, Iosub D, Couturaud F, Muñoz AJ, Biosca M, Lerede T, van Es N, Di Nisio M; UPE investigators. The prognostic value of respiratory symptoms and performance status in ambulatory cancer patients and unsuspected pulmonary embolism; analysis of an international, prospective, observational cohort study. J Thromb Haemost. 2021 Nov;19(11):2791-2800.

[4] Haque F, Ryde J, Broughton L, Huang C, Sethi S, Stephens A, Pillai A, Mirza S, Brown V, Avery G, Bozas G, Maraveyas A. Validation of the HULL Score clinical prediction rule for unsuspected pulmonary embolism in ambulatory cancer patients. ERJ Open Res. 2023 May 2;9(3):00651-2022.