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Original Research

Image-guided tumour biopsies in a prospective molecular triage study (MOSCATO-01): What are the real risks?

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Abstract ***Purpose:*** To evaluate efficacy, complications and preprocedural risk factors for percutaneous image-guided core needle biopsy of malignant tumours for genomic tumour analysis.

Materials and methods: Procedural data for core biopsies performed at a single centre for the MOSCATO-01 clinical trial were prospectively recorded between December 2011 and March 2016. Data assessed included patient demographics, tumour characteristics, procedural outcomes and complications.

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Haemorrhagic;
Risk factors

Results: A total of 877 biopsies were performed under computed tomography (38.4%) or ultrasound guidance (61.6%) for tumours in the liver (n = 363), lungs (n = 229), lymph nodes (n = 138), bones (n = 15) and other miscellaneous sites (n = 124). Each biopsy harvested a mean 4.4 samples [1–15], with adequate tumour yield for genomic analysis in 95.3% of cases. Procedural complications occurred in 89 cases (10.1%), with minor grade I complications in 59 (66.3%); grade II in 16 (18%) and grade III in 14 (15.7%). No grade IV complications and no procedure-related death occurred. The most common complications were pneumothorax (51/89, 57.3%), haemorrhage (24/89, 27%) and pain (8/89, 8.9%). Predictive factors for complications by univariate analysis included biopsied organ (lung vs other), sample number, prone position, lesion size, lesion depth and biopsy approach. By multivariate analysis, only pulmonary biopsy was a significant risk factor (odds ratio = 27.23 [4.93–242.76], $p < 0.01$).
Conclusion: Percutaneous image-guided core needle biopsy in cancer patients provides an effective method to obtain molecular screening samples, with an overall low complication rate. Lung mass biopsies present a higher risk of complication, although complications are manageable by minimally invasive techniques without prolonged sequelae.

Implication for patient care:

- Percutaneous image-guided core needle biopsy for cancer molecular screening provides substantial sampling yield at a low complication rate.
- Extrapulmonary sampling is recommended when feasible to minimise risks; however, core needle biopsy of lung nodules is feasible with low overall risk of serious complications requiring hospitalisation.

Summary statement:

The paradigm shift to personalised cancer treatments hinges on identification of disease-specific genetic alterations. Although molecular techniques have rapidly advanced, the genomic analysis of tumour samples still requires the acquisition of sufficient tumour volume. To obviate the need for invasive open surgical biopsy, percutaneous core biopsies have been advanced as an effective alternative. Percutaneous core needle biopsies provide sufficient tumour sample volume for genomic analysis and may be safely obtained from the primary and metastatic disease throughout the extracranial body using imaging guidance. Overall complication rates are low. Biopsy of pulmonary lesions portends the greatest procedural risks. Although overall complication rates of lung biopsies are low and can be managed through minimally invasive techniques, percutaneous core biopsy should be obtained in extrapulmonary locations if feasible.

1. Introduction

The last decade has heralded profound advances in molecular oncology and cancer genetics that have defined many key molecular alterations and oncogenes responsible for cancer. As a result of these successes, targeted oncologic therapies have been applied to improve patient outcomes. A few examples include trastuzumab treatment in human epidermal growth factor-2 (HER2+) breast cancer [1], epidermal growth factor receptor inhibitors in selected lung cancer [2], ALK inhibitors in selected non–small-cell lung cancer [3] and BRAF inhibitors in BRAF-mutated melanoma [4]. Despite these exemplary advances, many cancers have proven to display resilient molecular heterogeneity [5].

One of the primary goals of personalised oncology is to identify subtle molecular alterations to develop new agents that act selectively to target uncontrollable cancers. To best tailor treatment with molecularly matched therapy, advanced laboratory techniques and equipment have been developed to facilitate high-throughput molecular screening at a reasonable cost. Several retrospective studies and prospective trials have shown that molecular screening is feasible in daily practice [6–11]. The application of these genetic techniques has encouraged innovation and fresh perspective that reshape the therapeutic strategies to be more patient tailored [12].

The molecular screening for cancer treatment optimisation (MOSCATO-01) study [13] is a prospective molecular screening programme conducted at a single comprehensive cancer centre (blinded). Molecular analyses are performed on tumour samples from cancer patients who may be candidates for early-phase clinical trials. To obtain the required tumour sample yield, multiple percutaneous core biopsies of a target tumour lesion are required. The structural DNA changes are identified by comparative genomic hybridisation (CGH) and next-generation sequencing. Sample processing and evaluation aims to optimise targeted therapy selection to meet specific cancer biology.