



## EDITORIAL COMMENT

## Balloon pulmonary angioplasty – welcome to chronic thromboembolic pulmonary hypertension treatment

### Angioplastia pulmonar com balão – bem-vindos ao tratamento da hipertensão pulmonar tromboembólica crónica

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Chronic thromboembolic pulmonary hypertension (CTEPH) is caused by unresolved pulmonary emboli replaced by fibrous scar tissue narrowing the affected pulmonary arteries, together with varying degrees of distal vasculopathy, combining to cause pulmonary hypertension (PH).<sup>1</sup> Without effective treatment, patients with CTEPH often succumb to right heart failure. The treatment of choice remains pulmonary endarterectomy surgery (PEA) – which removes the mechanical, obstructive component.<sup>2,3</sup> In many patients, this surgery can be an effectively curative intervention, with only the need for chronic anticoagulation therapy to prevent recurrence.<sup>4</sup> However, up to half of patients even after PEA were observed to have residual PH, possibly due to residual defects not fully treated by PEA.<sup>5</sup> Furthermore, even at experienced surgical centers, nearly 40% of patients are deemed to be inoperable for a multitude of reasons.<sup>6</sup> Additionally, these data come from a subgroup of patients who were seen at expert surgical centers – but what about all the other CTEPH patients without access to a PEA center?<sup>7</sup> Thankfully, this large unmet need and CTEPH treatment gap have been narrowed both by advances in medical therapy and balloon pulmonary angioplasty (BPA).<sup>8–12</sup> The report from Calé et al. is a fine example of the progress the field has witnessed in the treatment of CTEPH patients who previously had no other options.<sup>13</sup>

Calé et al. highlight several important take home messages for the modern approach to CTEPH treatment. First, the authors recognize BPA is not a replacement for PEA surgery, and PEA remains the treatment of choice for operable patients. They utilize a multidisciplinary review of each CTEPH case – including PEA surgeons, chest radiologists experienced in the assessment of pulmonary vasculature, PH specialists, and BPA interventionists. The multidisciplinary team approach is necessary to optimize patient selection and arrive at the best treatment for any individual CTEPH patient.<sup>3,12</sup> Secondly, for patients deemed inoperable and heading toward BPA, the authors optimize anticoagulation, volume and oxygenation management, and PH-targeted medical therapy. BPA is therefore performed in conjunction with optimal medical management and patient adherence to anticoagulation. Although the timing, necessity, and choice of PH-targeted medical therapy and BPA remain topics of debate and ongoing research, the authors recognize the importance of a multimodal approach to CTEPH management.

An important third message relates to the BPA strategy. The field of BPA in general still lacks consensus on favored imaging modality for BPA planning, specific imaging approach during BPA, or additional tools such as intravascular ultrasound, optical coherence tomography, pressure wires or catheters to measure gradients. However, what is uniformly shared across successful BPA programs is a cautious approach to wiring and dilations, recognizing the risk

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and prevalence of vascular injury, especially for patients with more severe PH.<sup>10–14</sup> Although BPA is understandably perceived to be less invasive than PEA, in fact the published rates of BPA-associated mortality coming from the most experienced BPA centers range from 1.8 to over 3%.<sup>10–12</sup> These mortality rates are similar to those reported from experienced CTEPH centers following PEA surgery.<sup>4,15</sup> Accordingly, the encouraging results of BPA need to be tempered with the awareness that this remains a highly specialized and risky intervention. Therefore, BPA should only be performed at experienced centers following a multidisciplinary assessment to ensure that this is the appropriate treatment.

Going forward there are many unanswered questions regarding BPA. Will there be uniformity in BPA approach in terms of optimal planning and technical nuances during interventions? What is the completion goal for BPA in an individual patient? What are reasonable and acceptable levels of complications and should there be an accreditation process for centers to consider establishing and maintaining a BPA program? How will BPA be incorporated as both PH medical therapies and skill of PEA surgical programs removing more distal defects continue to advance? These and other pressing practical concerns during a global pandemic (e.g. travel limitations for training) linger and will be topics for the field to address moving forward. For now, the advances in CTEPH assessments utilizing a multidisciplinary approach, and the option of BPA for patients deemed inoperable, are all welcome additions improving the lives of our patients with CTEPH.

## Conflicts of interest

Consultant for Bayer, Janssen, Merck, United Therapeutics; board member for International CTEPH Association, CTEPH.

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