Clinical Impact of Creating a Predetermined Atrial Communication in the Management of Severe Pulmonary Hypertension using the Atrial Flow Regulator Device

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Background
Pulmonary hypertension (PH) is a chronic progressive disease with mean pulmonary arterial pressure (MPAP) >25 mmHg, progressing to right ventricular dysfunction, heart failure, and death.

Medical management remains challenging with unpredictable outcomes. The efficacy of an interatrial shunt in severe PH is recognized.

A lack of interventional devices to create a sustainable interatrial communication led to the development of the Occlutech® Atrial Flow Regulator (AFR; Figure 1).

Methods
A retrospective, multi-center study was performed in patients with severe PH who underwent compassionate use of AFR in collaboration with physician implanters from 7 international centers.

Results
Thirty-five patients underwent implantation during a period of 3 years with follow-up data available on 27 patients (females n=21, 77%).

NYHA Class III/IV symptoms were observed in 77% of patients with syncope in all patients at baseline, 54% at short-term follow-up and only 9% at long-term follow-up with no recurrence of syncopal episodes in any patients (Figure 3).

The average 6 minute walk test distance improved from 370 m to 434 m (p=0.0001) at last follow-up (Figure 4) with expected decrease in oxygen saturation (Figure 5).

A significant decrease in mean right atrial pressure (RAP) was noted (N=11, 10.6 to 8.5 mmHg; F=15.27, p=0.0009) with trivial change in MPAP (N=11, 74.8 to 76 mmHg; S=7.5, p=0.5791) at long-term follow-up (Table 1).

No major complications were observed except in 1 patient who had spontaneous occlusion of the fenestration, but underwent successful heart-lung transplant 1-year after AFR implantation.

There were 4 deaths related to progressive ventricular dysfunction, severe desaturation, and co-morbidities.

There was no correlation between RAP and outcomes, specifically in those with RAP >20mmHg, a cutoff pressure formerly considered a contraindication for atrial fenestration in PH.

Conclusion
- Implementation of AFR results in significant clinical improvement in severe PH.
- Overall safety and tolerability was documented in our series, including patients with high RAP.
- This study paves the way for future trials to better determine optimal timing of intervention, device size selection, and long-term prognosis.

Clinical Implications
- The Occlutech® AFR is a novel device to create a predefined interatrial communication for decompression of the RA, which increases systemic ventricular output, and may be offered as a treatment option with optimized medical therapy for symptomatic patients with PH.
- The application of AFR may also be extended to patients with chronic refractory right and left-sided heart failure with elevated atrial pressures.

Collaborators
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Table 1. Change in hemodynamics after AFR Implantation (N=11)

<table>
<thead>
<tr>
<th>Time</th>
<th>Left Atrial Pressure (mmHg)</th>
<th>Right Atrial Pressure (mmHg)</th>
<th>Mean PA Pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>8.6±4.2</td>
<td>7.1±3.8</td>
<td>8.3±3.4</td>
</tr>
<tr>
<td>Intermediate</td>
<td>6.6±4.1</td>
<td>7.5±4.6</td>
<td>8.3±4.6</td>
</tr>
<tr>
<td>Long-term</td>
<td>7.4±1.7</td>
<td>7.0±1.7</td>
<td>7.6±1.7</td>
</tr>
</tbody>
</table>