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Background

- Posterior capsule rupture (PCR) is a cataract surgery complication that can occur for various reasons including standard metal phacoemulsification tips contacting the posterior capsule of the eye.¹
- Polymer-coated tips coated with a soft elastic material aim to improve the safety profile of phacoemulsification.
- A targeted literature search was conducted to identify the associated benefits of this phacoemulsification tip and to calculate the potential cost impact of avoiding PCR events compared to a standard metal tip.

Methods

- The PubMed database was searched from 2019/01/01 to 2023/06/30 for studies published in English that investigated the INTREPID[®] Hybrid tip and the potential impact on PCR events using combinations of the following terms:
 - “Phacoemulsification”, “cataract”, “posterior capsule rupture”, “INTREPID”, “balanced tip”, “hybrid tip”, and “polymer”
- A one-year economic model was developed to assess the budget impact of healthcare resource utilization for the treatment of PCRs using the metal INTREPID[®] Balanced Tip and the polymer INTREPID[®] Hybrid Tip from a US healthcare provider perspective; a hypothetical cohort of 1,000 patients was used.
- For the model, a baseline PCR rate of 3.0% in current clinical practice was assumed with a 2.8 x reduction in PCR rates with INTREPID[®] Hybrid Tip.²⁻³
- The model compared the costs for treating PCR events including additional operating room time, follow-up visits, medications, and procedures based on previously reported healthcare resource utilization estimates (Table 1).⁴⁻⁹
- Where necessary, costs were inflated to 2023 USD using the medical care component of the US Consumer Price Index.¹⁰

Table 1: HRU Unit Costs and Sources

Healthcare Resource Use	Unit Cost(s)	Source(s)
OR overhead	\$14.52 per minute	Taravella et al. 2014 ⁵
OR labor ^a	\$0.34-\$2.14 per minute	US Bureau of Labor Statistics ⁶
Materials/supplies ^b	\$62.83-\$944.00 per unit	Alcon data-on-file, ⁷ and the Navlin [®] database ⁸
Physician visits ^c	\$35.58 per visit	Medicare Physician Fee Schedule ⁹
Physician and facility time for postoperative clinic procedures, imaging, and OR procedures ^d	\$93.99-\$4,938.91 per procedure	Medicare Physician Fee Schedule ⁹

^a Includes a cataract surgeon and a technician. ^b Includes miotic agent, suture pack, steroid, viscoelastic, and a vitrectomy pack. ^c Costed using Common Procedural Terminology (CPT) code 99212. ^d Includes macular optical coherence tomography (OCT) (CPT 92134; modifier -26), barrier laser retinopathy (CPT 67220), laser vitreolysis (CPT 67031), paracentesis (CPT 65810), pars plana vitrectomy (CPT 67042), IOL repositioning (CPT 66825), and IOL exchange (CPT 66986).
Abbreviations: OR=Operating room; US=United States of America.

Results

- A total of five studies that evaluated the INTREPID[®] Hybrid Tip compared with the INTREPID[®] Balanced Tip were identified (randomized observational = 1; laboratory/experimental = 4; Table 2).^{2,3;11-13}

Table 2: Characteristics of Identified Studies

Study	Study Design	N Eyes	Outcomes Measured ^a
Shumway et al. 2019 ²	Experimental	20 (cadaver)	Vacuum power thresholds and torsional power thresholds to cause a PCR event
Sabur et al. 2022 ¹¹	Randomized, observational	168 (human)	CDE , total ultrasound time, torsional amplitude , aspiration time, fluid use, ECC, CCT, and active surge mitigation actuations in eyes with pseudoexfoliation or small pupil size
Cardenas et al. 2023 ¹²	Experimental	200 (porcine)	CDE and ultrasound times
Ichikawa et al. 2023 ³	Experimental	160 (porcine)	Aspiration power thresholds to cause a PCR event
Zacharias 2023 ¹³	Laboratory	N/Ap	Heat generation, acoustic output , ultrasound threshold for cavitation , and fluid turbulence

^a Bolded outcomes were statistically significant results favoring INTREPID[®] Hybrid Tip compared with INTREPID[®] Balanced Tip. Non-bolded outcomes reported no statistically significant difference between the two tips.
Abbreviations: CDE = cumulative dissipated energy; CCT = central corneal thickness; ECC = endothelial cell count; N/Ap = not applicable; PCR = posterior capsule rupture.

- The torsional power thresholds to cause a PCR event was 1.8–3.4 times higher with INTREPID[®] Hybrid Tip compared with INTREPID[®] Balanced Tip in paired cadaver or porcine eyes (Table 3).^{2,3} For the model, the INTREPID[®] Hybrid Tip was assumed to be 2.8 times less likely to cause a PCR event.

Table 3: Torsional Power Required to Cause Posterior Capsule Rupture Events with INTREPID[®] Hybrid Tip versus INTREPID[®] Balanced Tip

Study	Surgical Setting	Torsional Ultrasound Power		Power Multiplier Required for PCR with INTREPID [®] Hybrid Tip	P-Value
		INTREPID [®] Balanced Tip	INTREPID [®] Hybrid Tip		
Shumway et al. 2019 ²	Overall	14.1% ± 5.8%	45% ± 19.8%	2.19 x	<0.001
	Tip bevel down	12.5% ± 8.7%	35% ± 22.8%	1.8 x	<0.001
	Tip bevel up	13.8% ± 4.8%	55% ± 10.0%	2.99 x	<0.001
Ichikawa et al. 2023 ³	Aspiration: 0 mm Hg	22.5% ± 4.2%	98.0% ± 6.3%	3.34 x	<0.001
	Aspiration: 200 mm Hg	23.5% ± 4.7%	92.5% ± 7.9%	2.94 x	<0.001

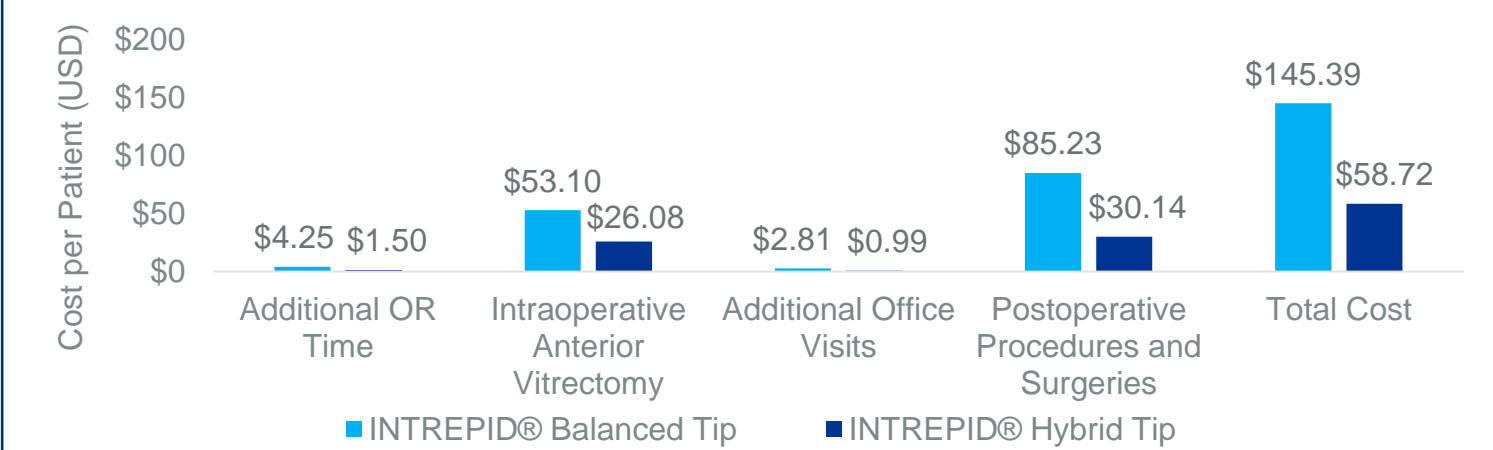
Abbreviations: mm Hg = millimeter(s) of mercury; PCR = posterior capsule rupture.

- Cumulative dissipated energy (CDE) outcomes were mixed; reported as lower (Grade 1-4 patient eyes) or similar (porcine lenses) CDE with INTREPID[®] Hybrid Tip (n = 2 studies).^{11;12}

Results Continued

- Over a one-year period, the model predicted cost savings with the INTREPID[®] Hybrid Tip of \$86.67 per patient (Figure 1) and \$86,670 over a year in the hypothetical cohort of 1,000 patients, or a 59.6% reduction in costs.

Figure 1: Posterior Capsule Rupture Costs per Patient with INTREPID[®] Hybrid Tip versus INTREPID[®] Balanced Tip (Provider Perspective)^a



^a A PCR rate of 3% was assumed for INTREPID[®] Balanced Tip which falls within the range of published PCR rates for staff and resident surgeons (0.2%-13.0%).^{14;15} The PCR rate for INTREPID[®] Hybrid Tip was calculated to be 1.1% (2.8x reduction).
Abbreviations: OR = operating room; PCR = posterior capsule rupture; USD = United States dollars.

Discussion & Conclusions

- The INTREPID[®] Hybrid Tip was estimated to be cost saving if PCR events were avoided compared with the INTREPID[®] Balanced Tip for healthcare providers due to the reduction in intraoperative and postoperative procedures required and the associated OR time, labor time, and materials.
- Limitations of the model included:
 - Baseline PCR rates with INTREPID[®] Balanced Tip and the estimated reduction with INTREPID[®] Hybrid Tip are based on assumptions.
 - Medicare reimbursement figures were used as a proxy for the cost associated with intraoperative and postoperative procedures given the lack of published data, which may differ from actual costs to healthcare providers.
- Current literature suggests that the INTREPID[®] Hybrid Tip may minimize the risk of PCRs compared with the INTREPID[®] Balanced Tip. However, future real-world evidence studies to assess this are warranted.

References

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