

# Membranous Therapeutic Plasma Exchange Utilising Prismaflex® in Drug-intolerant Thyroid Storm

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## Objectives

Describe a case of thyroid storm with contraindications to conventional medical management treated with membranous therapeutic plasma exchange (mTPE). Compare mTPE versus centrifugal therapeutic plasma exchange (cTPE) and choice of replacement fluid in mTPE.

## Materials and Methods

A PubMed database literature review was conducted for plasma exchange in thyrotoxicosis. Comparison was made to our case.

## Results

A 43-year-old lady with Grave's disease presented with influenza A pneumonia. She acutely worsened with features of thyroid storm including hyperthermia, hypercarbia, supraventricular arrhythmias and cardiogenic shock. Anti-thyroid drugs (ATD), hydrocortisone, Lugol's iodine and vasopressors were commenced. Beta-blockade was omitted due to severe left ventricular impairment.

Severe transaminitis necessitated cessation of ATD on day 3. mTPE was performed using the Prismaflex® system (Baxter International Inc., Deerfield, IL, USA) daily for 3 days with intention to bridge to thyroidectomy. 1.5x plasma volume, blood flow rates of 100 - 150 ml/min, heparinised circuit and replacement fluid was prescribed. The first two cycles used fresh frozen plasma (FFP) and albumin replacement fluid, both of which provide thyroid binding proteins. The last used albumin and crystalloids.

Despite initial clinical and biochemical improvement, acute worsening of cardiogenic shock on day 8 required veno-arterial extracorporeal membrane oxygenation (ECMO). She later died on high-flow ECMO configuration.

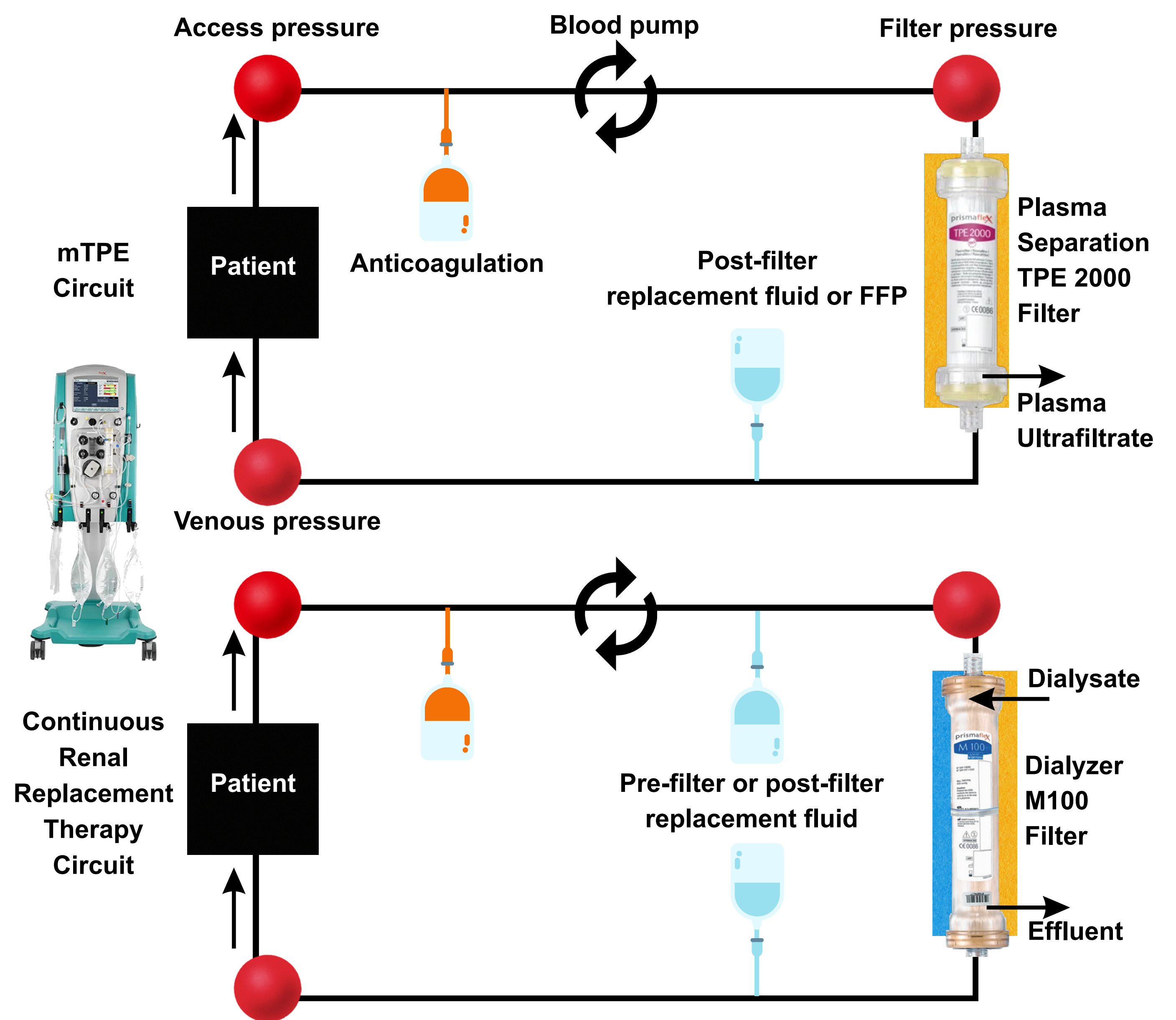


Figure 3: Both mTPE and continuous renal replacement therapy have similar circuit set ups. The main difference is the filter used.

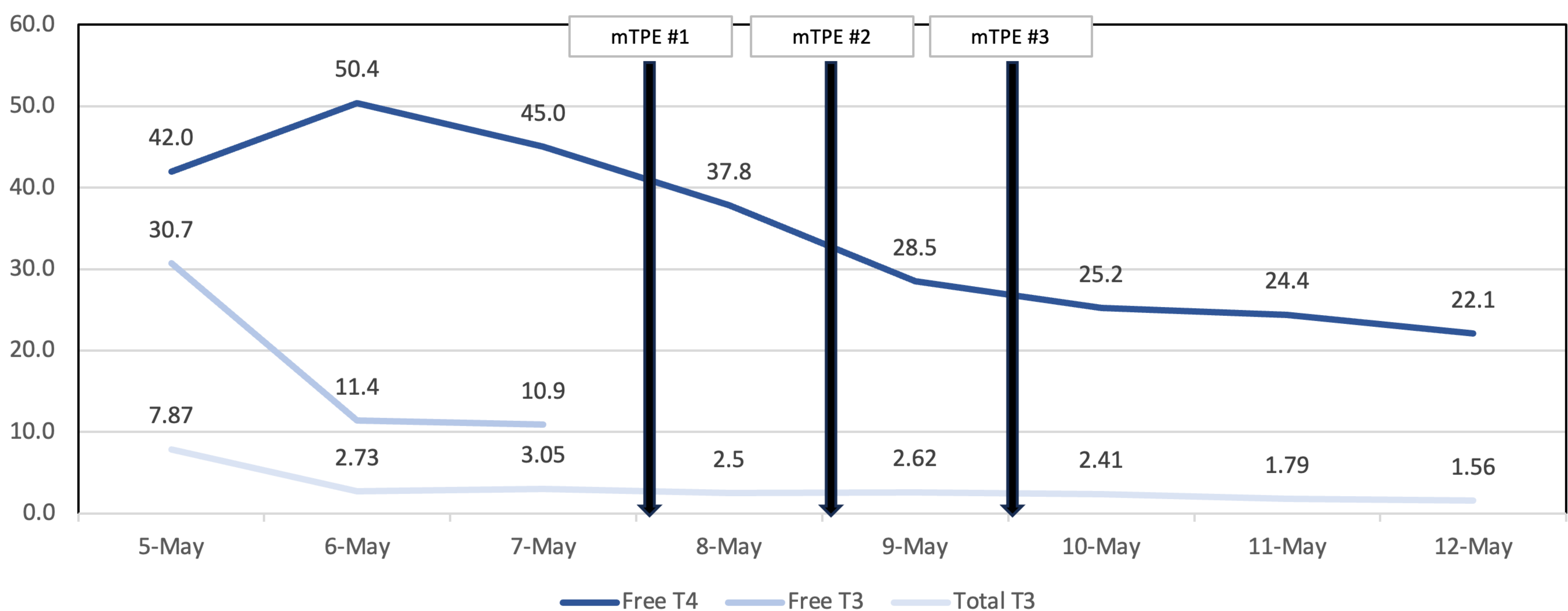


Figure 1: Thyroid hormone levels prior and post mTPE cycles.

Our case demonstrated decremental fT4 levels with sequential mTPE: 16.0%, 24.6%, 11.6% reduction with each cycle. This was consistent with reported literature showing average fT4 reduction of 12.3% and 22.4% for mTPE and cTPE respectively.

Our literature review found mTPE less frequently reported than cTPE as a modality for thyrotoxicosis (25 vs 146 patients). mTPE was as effective as cTPE in average percentage fT3 removed per cycle (20.9% vs 31.9%,  $p=0.12$ ). mTPE was less efficacious than cTPE for fT4 removal (12.3% vs 22.4%,  $p=0.03$ ). However, reported ranges of fT3 and fT4 removal were wide.

Clinicians prescribing mTPE used mainly albumin and crystalloid replacement fluids. FFP versus albumin and crystalloid use in cTPE had no significant effect on fT3 removal (39.7% vs 45.1%,  $p=0.84$ ) or fT4 (23.3% vs 18.7%,  $p=0.41$ ).

## Discussion and Conclusions

In the setting of thyroid hormone removal, mTPE utilising the Prismaflex® system in our case had efficacy comparable to reported literature for both mTPE and cTPE. mTPE may be an efficacious alternative to cTPE in thyrotoxicosis. Albumin and crystalloid remain suitable replacement fluids for thyroid hormone removal.

Specification	TPE 2000 Filter	M100 Filter
Indication	Plasma Exchange	SCUF, CVVH, CVVHD, CVVHDF (Middle molecules 500 – 60,000 Da)
Molecular Mass Cutoff (Da)	3 million	50,000 – 65,000
Pore Size (µm)	0.5	0.005 – 0.011
Fiber Material	Polypropylene	AN69: Acrylonitrile and sodium methallyl sulfonate copolymer
Hollow Fibers	Yes	Yes
Surface Area (m <sup>2</sup> )	0.35	0.9
Blood Volume in Filter (ml)	55	155
TMP (mmHg)	120 – 193	171
Blood Flow Rate (ml/min)	100 - 250	75 - 400
Anticoagulation	Heparin/Citrate	Heparin/Citrate
Sterilization	Ethylene oxide	Ethylene oxide

Sieving Coefficients	TPE 2000 Filter	M100 Filter
Urea ≈ 60 Da	Estimated to be 1	1
Creatinine ≈ 113 Da	Estimated to be 1	1
Myoglobin ≈ 17,000 Da	Estimated to be 1	0.70
Albumin ≈ 66,438 Da	0.97	<0.0045
IgG ≈ 150,000 Da	1	Estimated to be 0
IgA ≈ 160,000 – 385,000 Da	1	Estimated to be 0
IgM ≈ 900,000 – 1 million Da	0.92	Estimated to be 0

Table 1 & 2: Comparison between Prismaflex® TPE 2000 and M100 filters.

## References

- Baxter International Inc. Prismaflex TPE 2000 Plasmafilter, Instructions for Use. Deerfield, IL, USA: Baxter International Inc.; 2010.
- Baxter International Inc. Prismaflex M60/M100/M150 Instructions for Use. Deerfield, IL, USA: Baxter International Inc.

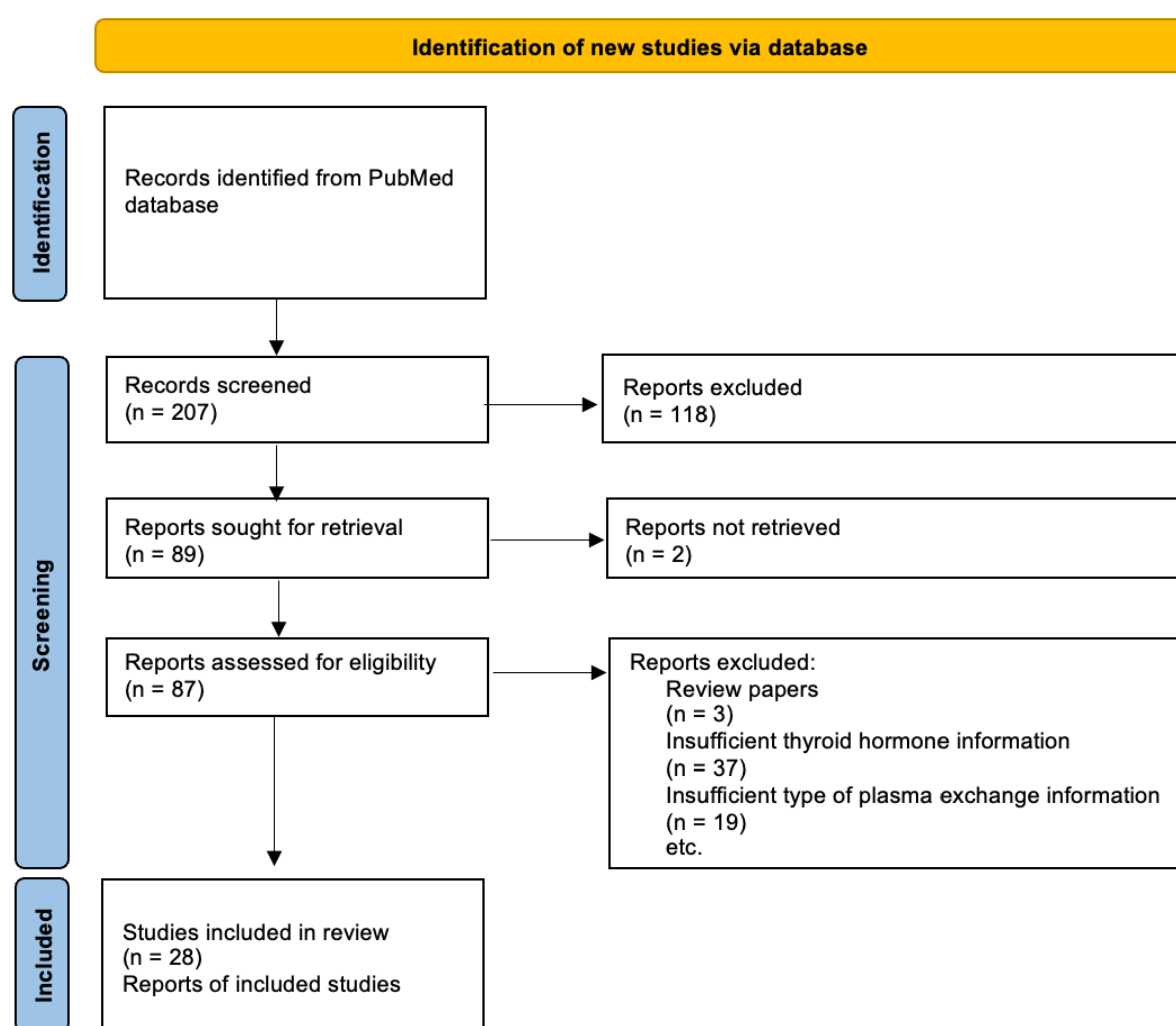


Figure 2: Flowchart of our systematic search in the literature review.