A Novel FLAIR PROPELLER Technique for T1-Weighted Brain Imaging

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INTRODUCTION

The Spin Echo (SE) sequence is widely used in the clinic for T1-weighted brain imaging. Compared to T1 SE, T1 FLAIR FSE has drawn significant attention recently [1, 2] due to its superior SNR and CNR, and improved lesion conspicuity. However, the diagnostic value of these Cartesian-based techniques is significantly impaired in regions affected by strong flow artifact, which is even worse in post-contrast imaging. By collecting multiple echoes during each SE period, turboprop [3] is capable of T1-weighted imaging and insensitive to flow artifact. In this work, we present a novel technique by combining FLAIR preparation with turboprop (T1 FLAIR PROPELLER) to produce superior T1 contrast with minimized flow artifact.

METHOD

As shown in the diagram (Figure 1), an inversion RF pulse is followed by the turboprop imaging segment invoked at the inversion time (TI). The initial Turbo PROPELLER sequence used in [3] was revised for this study without the Forced Recovery technique.

Volunteer and patient data were acquired with T1 FLAIR PROPELLER using an 8-channel brain coil on a GE SIGNA 3T scanner. The typical imaging parameters are: TR = ~2700 ms, TI = 800 ms, BW = ±250 kHz, Freq Resolution = 340, 5 gradient echoes per SE period, ETL = 5, FOV = 24×24 cm^2, and slice thickness = 5 mm. For comparison, T1 SE images were acquired with auto TR, TE ~ 17 ms, BW = ±15.6 kHz, matrix size = 352×256, FOV = 24×18 cm^2, and NEX = 1. Regular T1 FLAIR images were also acquired with TR = ~2700 ms, TI = 800 ms, BW = ±31.25 kHz, ETL = 7, and NEX = 2.

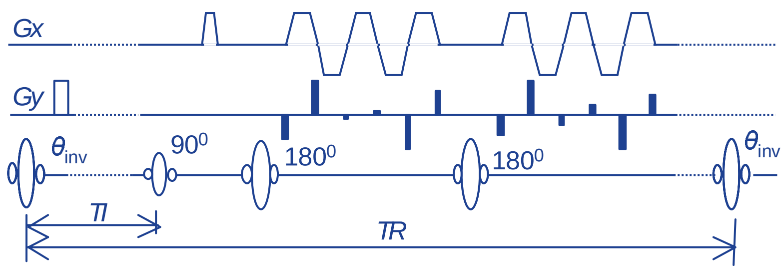

Fig. 1 Diagram of T1 FLAIR PROPELLER (slice selection gradients not shown)

RESULTS AND DISCUSSION

Figure 2 shows volunteer data acquired with (a) T1 SE, (b) T1 FLAIR, and (c) T1 FLAIR PROPELLER, respectively. Post-contrast patient results are illustrated in Figure 3: (a) T1 SE and (b) T1 FLAIR PROPELLER, respectively (regular T1 FLAIR image not shown here). From Figure 2, it is observed that both T1 FLAIR (Fig. 2b) and T1 FLAIR PROPELLER (Fig. 2c) images have better contrast and SNR than T1 SE images (Fig. 2a), consistent with the findings in [1,2]. Due to the inherent insensitivity to flow motion of the PROPELLER technique, as clearly demonstrated in Fig. 3b, T1 FLAIR PROPELLER also enables us to obtain images with minimal flow artifacts, which are pronounced in the T1 SE image (indicated by the arrows in Fig. 3a) as well as regular T1 FLAIR images (not shown).

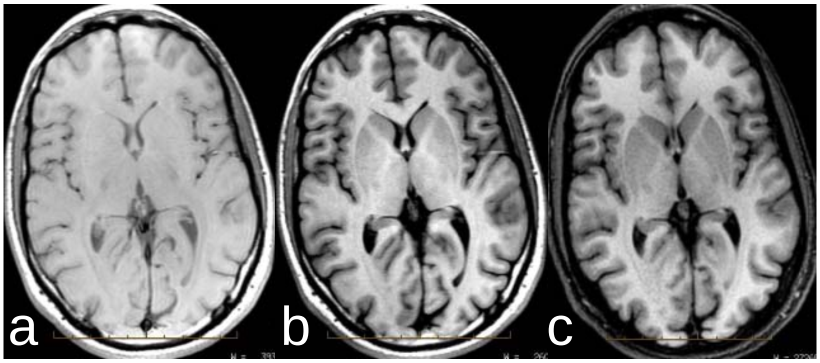

Fig. 2 Volunteer data acquired with (a) T1 SE, (b) T1 FLAIR, and (c) T1 FLAIR PROPELLER, respectively.

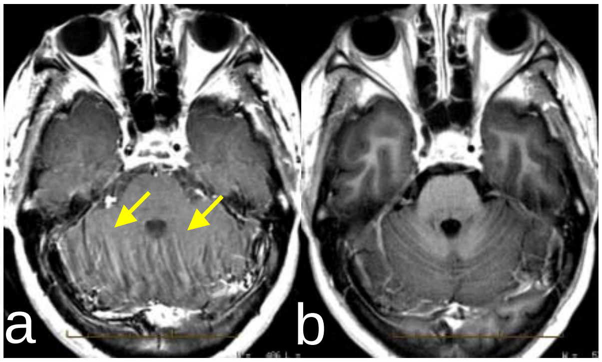

Fig. 3 Post-contrast images acquired with (a) T1 SE and (b) T1 FLAIR PROPELLER.

CONCLUSION

In summary, T1 FLAIR PROPELLER produces strong T1 contrast with high SNR and minimized flow artifacts, inherited from both the FLAIR and PROPELLER techniques. This novel technique can be used for both pre- and post-contrast T1 imaging, and has several advantages over current clinical T1 SE protocols.

REFERENCES

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