PURPOSE: The increasing demand for radiopharmaceuticals to be provided reproducibly and flexibly with high frequency for clinical application and animal imaging would be better met by improved or even new strategies for automated tracer production. Radiosynthesis in microfluidic systems, i.e. narrow tubing with a diameter of approximately 50-500 microm, holds promise for providing the means for repetitive multidose and multitracer production. In this study, the performance of a conceptually simple microfluidic device integrated into a fully automated synthesis procedure for in-capillary radiosynthesis (ICR) of clinical grade \([18F]FDG\) was evaluated.

MATERIALS AND METHODS: The instrumental set-up consisted of pumps for reagent and solvent delivery into small mixing chambers, micro-fluidic capillaries, in-process radioactivity monitoring, solid-phase extraction and on-column deprotection of the \((18)F\)-labelled intermediate followed by on-line formulation of \([18F]FDG\). RESULTS: In-capillary \((18)F\)-fluorination of 2.1 micromol 1,3,4,6-tetra-O-acetyl-2-O-trifluoromethanesulphonyl-beta-D-mannopyranose (TATM; precursor for \([18F]FDG\)) in acetonitrile (MeCN) at a flow rate of 0.3 ml/min within 40 s and subsequent on-line hydrolysis of the intermediate by treatment with 0.3 M NaOH for 1 min at 40 degrees C resulted in a radiochemical yield of 88 +/- 4% within97%, MeCN<5 microg/ml and similar absolute yields (approximately 1.4 GBq).
CONCLUSION: The described ICR process is a simple and efficient alternative to classic radiotracer production systems and provides a comparatively cheap instrumental methodology for the repetitive production of [(18)F]FDG with remarkably high efficiency and high yield under fully automated conditions. Although the results concerning the levels of activity need to be confirmed after installation of the equipment in a suitable GMP hot-cell environment, we expect the instrumental design to allow up-scaling without major difficulties or fundamental restrictions. Furthermore, we are convinced that similar or nearly identical procedures, and thus instrumentation, will allow ICR of other (18)F-labelled radiopharmaceuticals.