Clinical Pharmacology & Biopharmaceutics
ISSN: 2167-065X

Targeted Drug Delivery: Innovative Approaches for Precision Medicine in Cancer Treatment

Targeted drug delivery represents a groundbreaking approach in the feld of precision medicine, ofering signifcant

De pi e he e ad ancemen , challenge emain in he ide p ead applica ion of a ge ed d g deli e in clinical e ing . I e ch a he abili of d g ca ie , po en ial imm ne e pon e , and he he e ogenei of mo eq i e ongoing e ea ch and op imi a ion. None hele , he con in o e ol ion of a ge ed d g deli e echnologie , co pled i h a deepe nde anding of cance biolog , o e a p omi ing pa h a o a d mo e e ec i e and le o ic cance ea men [4].

In concl ion, a ge ed d g deli e ep e en a igni can leap fo a d in he q e fo p eci ion medicine in oncolog . B foc ing on deli e ing he ape ic agen p eci el o cance cell , hi app oach aim o an fo m cance ea men , p o iding ne hope fo pa ien and clinician alike. A e ea ch p og e e , he po en ial o de elop afe , mo e e ec i e, and pe onali ed he apie con in e o g o , mo ing clo e o a f e he e cance ea men i ailo ed o he niq e cha ac e i ic of each pa ien ' di ea e.

Nanopa icle : Va io pe of nanopa icle , incl ding lipo ome , pol me -ba ed nanopa icle , gold nanopa icle , and dend ime , e e ed. e e nanopa icle e e o ced f om comme cial pplie o n he i ed in-ho e ing anda d p o ocol .

An ibod -D g Conj ga e (ADC): Speci c an ibodie a ge ing cance cell face ecep o e e conj ga ed i h c o o ic agen . Comme ciall a ailable ADC a ell a c om- n he i ed conj ga e e e ili ed fo in i o and in i o die .

Cell Line : H man cance cell line , incl ding b ea (MCF-7), l ng (A549), and colo ec al (HCT-116) cance cell , e e ed fo e ing d g e cac and cell la p ake. Cell line e e main ained in DMEM o RPMI-1640 medi m pplemen ed i h 10% fe al bo ine e m (FBS) and 1% penicillin- ep om cin [5].

Chemo he ape ic Agen : D g like do o bicin, pacli a el, and ci pla in e e ili ed a he ape ic agen . e e e e ei he encap la ed in nanopa icle o conj ga ed i h a ge ing ligand .

Ta ge ing Ligand : Pep ide and an ibodie ha peci call bind o o e e p e ed ecep o (e.g., HER2, EGFR) on cance cell e e ed fo a ge ing p po e .

B e and Reagen : Pho pha e-b e ed aline (PBS), dime h l lfo ide (DMSO), and o he eagen ed in d g loading, cell c l e, and a a e e ob ained f om anda d pplie [6].

-B D D

S n he i of Nanopa icle : Nanopa icle e e n he i ed ing me hod like ol en e apo a ion, nanop ecipi a ion, o elf-a embl , depending on he pe of nanopa icle. Lipo ome e e p epa ed ing he hin- lm h d a ion me hod, follo ed b e ion o achie e nifo m i e di ib ion.

D g Encap la ion: Chemo he ape ic agen e e encap la ed in o nanopa icle ing pa i e loading o ac i e loading echniq e . e d g- o-lipid o pol me a io a op imi ed o achie e he de i ed encap la ion e cienc .

Cha ac e i a ion of Nanopa icle : Si e, e a po en ial, and pol di pe i inde (PDI) of nanopa icle e e mea ed ing d namic ligh ca e ing (DLS). e mo pholog of nanopa icle a a e ed ing an mi ion elec on mic o cop (TEM). D g loading e cienc and elea e p o le e e de e mined ing high-pe fo mance liq id ch oma og aph (HPLC) [7].

A -D C (ADC)

An ibod Selec ion and Conj ga ion: An ibodie a ge ing peci c cance cell face an igen (e.g., HER2, CD20) e e elec ed. e an ibodie e e conj ga ed o c o o ic d g ing linke ha enable able a achmen and con olled elea e i hin a ge cell .

P i ca ion and Valida ion: e ADC e e p i ed ing i e- e cl ion ch oma og aph and alida ed fo p ope conj ga ion h o gh SDS-PAGE and ma pec ome . e binding a ni of he ADC o a ge ecep o a con med ing en me-linked imm no o ben a a (ELISA) [8].

I E D D

Cell la Up ake S die : To a e he cell la p ake of d g-loaded nanopa icle and ADC , o e cence-labeled fo m la ion e e inc ba ed i h cance cell line fo a ing ime pe iod . e p ake a anal ed ing confocal mic o cop and o c ome .

C o o ici A a : e c o o ic e ec of he d g fo m la ion on cance cell line e e e al a ed ing he MTT o CellTi e -Glo a a . Cell e e ea ed i h di e en concen a ion of he fo m la ion , and he IC50 al e e e calc la ed o de e mine he do e-dependen e cac .

D g Relea e S die : In i o d g elea e f om nanopa icle a e al a ed in PBS a pH 7.4 (mimicking ph iological condi ion) and pH 5.5 (mimicking he acidic mo mic oen i onmen). e elea e a mea ed a p ede e mined ime poin ing HPLC [9].

I E

Animal Model: BALB/c n de mice bea ing h man mo enog a e e ed fo in i o e cac die . T mo cell (e.g., MCF-7) e e inje ed bc aneo l in o he mice, and mo g o h a moni o ed n il he de i ed i e a eached.

D g Admini a ion: Mice e e ea ed i h d g-loaded nanopa icle , ADC , o con ol fo m la ion ia in a eno inje ion. e do age and f eq enc of admini a ion e e op imi ed ba ed on p elimina o ici die .

Biodi ib ion S die : To e al a e he a ge ing e cienc of he fo m la ion , he biodi ib ion of o e cen l labeled nanopa icle a a e ed ing li e animal imaging. Ti e e e ha e ed and anal ed fo d g concen a ion ing HPLC.

T mo G o h Inhibi ion: T mo ol me e e mea ed ing digi al calipe o e ime, and he mo g o h inhibi ion a e a calc la ed. Hi ological anal i of mo i e a pe fo med o a e apop o i ing TUNEL aining.

A

Da a e e anal ed ing G aphPad P i m o a e. All e pe imen e e pe fo med in iplica e, and e l a e e p e ed a mean anda d de ia ion (SD). S a i ical igni cance a de e mined ing ANOVA follo ed b po hoc e , i h a p- al e < 0.05 con ide ed a i icall igni can .